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POLLUTION OF THE INTERSTATE WATERS OF THE LOWER MISSISSIPPI RIVER. PROCEEDINGS OF CONFERENCE HELD AT NEW ORLEANS, LOUISIANA ON MAY 5-6, 1964. VOLUME IV

Public Health Service
Washington, D. C.

6 May 1964

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CONFERENCE

in the matter of

Pollution of the Interstate Waters of the

LOWER MISSISSIPPI RIVER

PROCEEDINGS

Volume IV

May 5-6, 1964
New Orleans, Louisiana

U.S. Department of Health, Education, and Welfare
Washington, D.C.

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AFTERNOON SESSION

(1:45 p.m.)

MR. STEIN: May we reconvene?

I will call on Arkansas again.

MR. WOOD: Mr. Richard Deed, Vice Chairman of the Arkansas Water Pollution Control Commission, will present the Commission's statement.

STATEMENT OF RICHARD N. DEED, CONFEREE AND VICE CHAIRMAN OF THE ARKANSAS WATER POLLUTION CONTROL COMMISSION

MR. DEED: Mr. Chairman, members of the conference, ladies and gentlemen:

My name is Richard N. Deed and I am Vice Chairman of the Arkansas Water Pollution Control Commission. The following is my statement:

In the interim since receipt of the notice of this interstate enforcement conference on April 6, the Arkansas Water Pollution Control Commission has reviewed the "Report on Investigations of fish kills in the Lower Mississippi River, Atchafalaya River, and Gulf of Mexico," dated April 6, 1964. The Commission feels that, although the findings of the report with respect to possible causes of the fish kills may be significant and present sufficient basis to justify further and more intensive cooperative study between the States concerned, they do not in themselves form sufficient grounds for the holding of an enforcement conference under the provisions of Public Law 660 (as amended) and limited to the 4 States represented at this time. A review of the organic content of the Mississippi River, as reported in the National Water Quality Network data since 1957-58, indicates decreasing concentrations of organics in the river as it progresses from Cape Girardeau, Missouri, to its mouth. The singular and obvious conclusion which can be drawn is that the tributary waters of the 4 States represented here contain lesser quantities of organic waste material and are, therefore, by dilution decreasing the organic contaminant concentration of the Mississippi River.

The Commission has completed surveys of 40% of the area of the State of Arkansas. The data incorporated in these surveys, in National Water Quality Network compilations and in U. S. Geological Survey quality data, clearly indicate that the water quality of each stream entering the State improves before it leaves our borders. The same sources will substantiate a continuing improvement in the water quality at the State lines of any stream which rises within our borders and is interstate in nature. Commission abatement plans have resulted in a decrease of 1,680,000,000 pounds per year of one inorganic contaminant in one stream alone.

At the start of the Public Law 660 construction grants program the Commission initiated a 10-year plan to insure adequate treatment of all municipal sewage. The success of this plan is apparent from the fact that last fiscal year Arkansas rose from 9th to 7th in the nation in cumulative number of municipal projects. Total expenditures for these projects ranked 23rd in the nation. The 10-year plan is well on schedule and is expected to remain so.

In view of the widespread implications and contradictory information involving the problem under consideration here today, it is the recommendation of the Arkansas Water Pollution Control Commission to this conference that the subject States initiate such studies as the findings of the conference indicate necessary to clearly delineate the sources, amounts, and effects of wastes entering the Mississippi and contributing to the problem of fish mortality; and that each State, to the extent necessary, utilize such technical services and resources of the United States Public Health Service as that agency might be able to supply in order to work for a prompt, complete, and continuing solution to the current problem.

Speaking for the Commission, I would like to enter this statement for the record.

MR. STEIN: Thank you.

Are there any comments or questions?

(No response.)

MR. STEIN: If not, thank you very much, sir.

Mr. Wood?

MR. WOOD: I might make one note to the effect that the statement is based on a review of the April 6th report, which was mentioned in the statement, and that we did not receive the report which was used as a presentation of the Service yesterday until we arrived at this conference yesterday morning.

MR. STEIN: Does that conclude the presentation of Arkansas?

MR. WOOD: That concludes the presentation. Yes.

MR. STEIN: At this point we would like to call on the State of Mississippi, Mr. Johnston.

MR. JOHNSTON: Thank you, Mr. Chairman.

I would like to begin by going off the record, if that is permissible.

MR. STEIN: It is permissible.

(Discussion off the record.)

STATEMENT OF J. E. JOHNSTON, DIRECTOR, SANITARY ENGINEERING, MISSISSIPPI STATE BOARD OF HEALTH; AND CONFEREE

MR. JOHNSTON: To get back on the record now, it is certainly a privilege to be here. This has been a most enlightening meeting to me. I came here with very little knowledge and information about the Mississippi River, and I sure got a lot of information here. It certainly will provoke our thinking in Mississippi.

We have two people from Mississippi who would like to make statements.

I would like at this time to call on Dr. Porter. Dr. Porter is Superintendent of the Delta Experiment Station Branch of the Mississippi State University.

Dr. Porter.

STATEMENT OF DR. WALTER K. PORTER, JR., SUPERINTENDENT OF THE DELTA BRANCH OF THE MISSISSIPPI AGRICULTURAL EXPERIMENT STATION, STONEVILLE, MISSISSIPPI

DR. PORTER: I have a few points that I would like to enter into the record.

Endrin is an important insecticide to the $325 million cotton industry in the Yazoo, Mississippi, Delta. It is used for bollworms in from 30 to 50 percent of the cotton acreage, and its use may increase if the bollworms continue to show resistance to the DDT.

Second, Aldrin is important to the rice industry in this same belt area of the Mississippi and is used for a seed treatment.

Thirdly, all agricultural agencies, both public and private, have been and are working with farmers and applicators in an educational program aimed at correct usage in an all-out safety program.

When we say "correct usage," we mean following the instructions, the legal description that is shown on the label of any particular pesticide.

Fourth, it is respectfully requested that no action be taken to modify or restrict usage on Aldrin or Endrin until such time as data might become available to show that correct agricultural usage is contributing to the river contamination problem.

The data presented so far at this hearing has not indicated in any way that correct agricultural usage is a contributing factor to water pollution.

Thank you.

MR. STEIN: Thank you very much.

Are there any comments or questions?

(No response.)

MR. STEIN: If not, thank you.

Mr. Johnston?

MR. JOHNSTON: The next Mississippi representative will be Dr. Ferguson, Professor of the Department of Zoology at the Mississippi State University, who has done a good deal of research work along this line.

STATEMENT OF DR. DENZEL E. FERGUSON, DEPARTMENT OF ZOOLOGY, MISSISSIPPI STATE UNIVERSITY

DR. FERGUSON: Mr. Chairman, members of the conference, and ladies and gentlemen:

I am Denzel E. Ferguson. I am Associate Professor of Zoology at Mississippi State University.

In 1962 we began a series of investigations, supported by a grant from the National Institutes of Health, in which the insecticidal tolerances of aquatic vertebrate animals from in and near cotton fields were compared with similar data for the same species living in localities where pesticides were not used. These comparative studies revealed that mosquito fish (Gambusia affinis) and two species of cricket frogs (Acris crepitans, A. gryllus) in certain cotton producing areas were resistant to DDT, especially those from the Mississippi Delta of Mississippi. We later reported Aldrin resistance in Delta cricket frogs and resistance to Endrin, Aldrin, Dieldrin, Heptachlor, Strobane, toxaphene, lindane, and methyl parathion in Delta mosquito fish. Preliminary studies are now complete for three additional species of fish.

D. E. Ferguson

Resistant fish are seined from canals, streams, and bayous in the Yazoo Basin of the Mississippi Delta where insecticide contamination is a virtual certainty through either direct application or runoff. Most such sites are completely surrounded by cotton fields. Untreated fish are obtained from nonagricultural areas and stock ponds located near State College, Mississippi. All fish are held 24 hours in the laboratory before being placed in acetone-insecticide solutions diluted to the desired concentration with tap water. Procedures and test conditions are those recommended for bioassay. A comparison of susceptible and resistant populations of the four species of fish is shown in Table 1, which I will read.

Table 1 is entitled "A Comparison of Approximate 36-Hour TLm Values."* You recall from yesterday that this refers to a median tolerated limit. In this case it is the concentration which produces 50 percent mortality in 36 hours, so this is a comparison of approximately 36 hours TLm values in parts per billion for nonresistant (State College, Mississippi) and resistant (Delta) populations of four species of fish.

SPECIES	STATE COLLEGE TLm	DELTA TLm	DIFFERENCE
Mosquito fish, Gambusia affinis			
Endrin	1	120	120X
Dieldrin	16	500	31X
Aldrin	50	2,100	42X
Strobane	100	30,000	over 300X
Golden shiner, Notemigonus crysoleucas			
Endrin	2	365	182X
Dieldrin	18	3,250	180X
Aldrin	72	over 5,000	over 69X
Green sunfish, Lepomis cyanellus			
Endrin	1.25	575	329X
Dieldrin	33	650	20X
Aldrin	55	1,200	22X
Bluegill, Lepomis macrochirus			
Endrin	1.75	over 400	over 229X
Dieldrin	17	---	---
Aldrin	18	---	---

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* Median tolerated limit. The concentration which produces 50% mortality in 36 hours.

The level of resistance in Delta fish is actually higher than indicated in Table 1 for two reasons:

D. E. Ferguson

1. Delta fish already contain rather large amounts of insecticide when they are collected in the field. A golden shiner contained 6,700 ppb Endrin when collected. Another from the same seine haul contained 16,300 ppb Endrin after being placed in a 300 ppb test concentration for 36 hours. The amount of insecticide to which a fish is subjected in a test merely adds to that already accumulated in the tissues. The residue levels in fish from impoundments receiving direct run-off from fields must certainly exceed those for Mississippi River fish.

2. Many test fish survive concentrations and periods of exposure greatly exceeding those in the 36-hour TLm values. For example, green sunfish have survived 36 hours in 600 ppb Endrin, 3,000 ppb Aldrin, and 1,800 ppb Dieldrin. Two of four green sunfish survived 15 days on 500 ppb Endrin (which is 3,730 times the maximum amount recorded from the lower Mississippi River); also, 3 of 4 survived 500 ppb Dieldrin, and 5 of 5 survived 500 ppb Aldrin for 15 days. Two of three shiners survived 60 hours at 7,000 ppb Dieldrin, and 1 of 3 survived 15,000 ppb Aldrin. Considering the low solubilities of these chemicals, it would be virtually impossible to get a sufficient quantity dissolved in a body of natural water to kill all or even a significant number of resistant fish.

D. E. Ferguson

A number of facts appear pertinent:

1. Every aquatic species studied in the Mississippi Delta to date has proved to be resistant. In our investigations, 22 species of fish have been collected in waters inhabited by resistant fish. Some or all of these are very likely resistant.

2. It seems logical to expect tributaries and impoundments near cotton fields to contain higher concentrations of insecticides than the Mississippi River. Why have there been no massive fish kills in these tributaries? One bayou from which we obtained fish was heavily contaminated by run-off and washings from spray equipment. When the owner observed dead fish, he fenced it to keep out fishermen. We collected a large number of perfectly healthy fish belonging to several species from inside his fence.

3. Fish tested in the laboratory do not exhibit symptoms described for sick and dying fish observed in the Mississippi River. I might add, of course, we have not worked with catfish. Species studied by us did not bleed from the mouth, belch air, or bloat. Some swam at the surface part of the time, but not necessarily upside down.

4. In mosquito fish, resistance is hereditary and continues to be expressed in descendants of resistant fish after several generations in insecticide-free waters.

Even among susceptible populations, occasional individuals are able to tolerate very high concentrations of pesticide, indicating the presence of a potential for resistance.

5. We have not studied fish from the Mississippi River, nor have we tested the species reported as killed. However, several species of catfish have been taken in our investigations from sites containing resistant fish; and commercial fishermen continue to take good catches of catfish and buffalo from the Yazoo River near Belzoni, Mississippi.

In conclusion, the quantities of insecticides in the Mississippi River, as reported to me -- and these are older figures, older than yesterday -- (.054 to .134 ppb, Endrin) probably would not harm susceptible fish studied by us. It is inconceivable that these small amounts could cause mass mortality among resistant fish. Admittedly, fish have been killed in the past and some are being killed now, otherwise resistance, which is a consequence of past selective mortality, could never have developed. I have found dead shad, gar, buffalo, and catfish in Delta waters, but these were isolated individuals rather than multiple kills. I believe that this constant weeding-out of less resistant individuals and the survival and reproduction of the more resistant ones is the basis of fish resistance to pesticides.

If it is assumed, for the moment, that the

Mississippi River kill is the result of insecticides, and I think it highly questionable on the basis of our findings and the low concentrations of toxicants reported from the river water, our work seems to indicate that although mortality occurs, fish populations survive concentrations of insecticides encountered as a result of current and past agricultural practices and develop resistance in the process.

As residues accumulate in headwaters of streams, one might expect resistance to gradually spread downstream from the source of contamination. In such a case, it is conceivable that fish could die far down stream from a source of pesticides and be unaffected in the between area. However, in view of the long period during which Endrin has been used as a cotton insecticide and the low concentrations in river water, it seems most unlikely that the present Mississippi River kill could involve such a condition.

Thank you.

MR. STEIN: Thank you, sir.

Are there any comments or questions?

(No response.)

MR. JOHNSTON: Thank you, Dr. Ferguson.

We have several other people from Mississippi. They have not indicated that they would like to make statements, but I would be delighted to invite them to make a statement at this time, if they wish to, if they will rise and identify themselves.

(No response.)

MR. JOHNSTON: I don't believe anyone else wants to make a statement, Mr. Chairman.

MR. STEIN: Thank you, Mr. Johnston.

We will now call on Louisiana, Mr. Lafleur.

STATEMENT OF ROBERT A. LAFLEUR, CONFEREE AND EXECUTIVE SECRETARY, LOUISIANA STREAM CONTROL COMMISSION

MR. LAFLEUR: Thank you, Mr. Chairman.

Member conferees, ladies and gentlemen:

I have a statement here that I would like to submit for the record.

We in Louisiana have, through the years, encountered many fish kills attributable to a number of natural and man-made causes. For many years the principal causes of these fish mortalities were of natural origin, with an occasional mortality being the result of industrial discharge of toxic wastes or waste with high organic content that cause oxygen depletion kills. However, in recent years kills caused by insecticides have become an important part of the fish mortality picture in Louisiana.

At the outset, let me say that we make a distinction between two types of kills caused by insecticides. The first type is an acute shock kill produced by sudden exposure to relatively high concentrations of insecticide and is nonpreferential with respect to species of fish. The second is a chronic species-discriminating kill caused by what is believed to be long-term exposure to extremely low concentrations of insecticides.

Scattered acute kills have been noted in Louisiana for a number of years. However, these were usually in conjunction with abnormal occurrences such as accidental or intentional dumping of insecticides into a waterway, and were rarely the result of normal agricultural practices. Only since 1958 and the advent of the use of Endrin for control of the sugar-cane borer have mortalities caused by insecticides become a major factor.

As stated before, the acute kills are of a nonspecific nature. That is to say, they have killed all species of fish from the most sensitive, such as shad, to the most resistant, gar and bowfin. In addition, they have been limited to small concise watersheds and have been of great intensity and short duration.

Lack of instrumentation sufficiently sensitive to detect the minute quantities of certain insecticides such as Endrin that are capable of producing acute kills, a condition now corrected, has forced us to use indirect methods to determine that Endrin was the cause of many fish mortalities.

On the negative side, checks on natural environmental factors, dissolved oxygen, pH, temperature, etc., have indicated that they were all well within the accepted limits for maintenance of a well-rounded aquatic population. Industrial discharges were known to be absent. Blooms of toxic algae as a possible cause were eliminated by microscopic examination of the waters.

On the positive side, all these kills attributed to insecticides such as Endrin occurred in watersheds draining areas where sugar cane is grown. They occurred only during the season that Endrin was being applied to the sugar cane for control of the cane borers. They were correlated with run-off from moderate to heavy rains following application of Endrin in the area. The species composition and the severity of the kills indicated that they were caused by some highly toxic material. The behavior of the dying fish strongly indicated that the toxin involved was one of the chlorinated hydrocarbons.

Even though these acute kills are restricted to our lesser waterbodies and have not affected our major streams, such as the Mississippi and that part of the Atchafalaya River into which the Mississippi can and does flow, they are a cause for concern. As many as fifty or more kills have been observed by our personnel in a single season. In addition, several of the mortalities, e.g., ones in Blind River, Bayou Barthelomew, Bayou Black, and Bayou Choctaw, have involved as much as 100,000 pounds of fish in a single kill.

The first reported fish die-off, of a type that has since become a chronic problem during the late fall and winter months, occurred in the Atchafalaya River near Krotz Springs on November 17, 1960. This was rapidly followed by reports of fish mortalities from widespread localities in the Mississippi River and the Atchafalaya River Basin. Ultimately, mortality was noted in the Mississippi River from the mouth of the river to Lake Providence, Louisiana, some 500 miles upstream. In addition, mortality in some marine forms was noted in brackish bays near the mouth of the Mississippi. Fish were neither reported nor observed dying in the Atchafalaya Drainage Basin (the Red and Black Rivers) above the Old River connection with the Mississippi River, but they were observed to be dying in this basin from Old River to Morgan City.

Species of fish affected in the Mississippi and Atchafalaya included catfish, buffalo, fresh water drum, and threadfin shad. Approximately 95 percent of the dying fish were catfish. Most of the catfish found dead or dying, particularly in the backwater areas of the Atchafalaya Basin, were individuals six to eight inches in length that would be from the 1960 spring hatch. However, proportionate numbers of larger fish were noted, including some weighing 25 pounds or more.

Dissolved oxygen and pH determinations were made at all locations where dying fish were checked by our personnel. In all cases the pH fell within a satisfactory range of 6.8 - 8.2 and the dissolved oxygen content was in excess of 7 ppm and approaching saturation for the prevailing water temperatures. Additional water quality tests made in a number of cases gave no clue to the cause of mortality.

Observations of dead or dying fish revealed several rather constant phenomena. Most of the catfish were bleeding around the mouth, and many were bleeding about the fins. In every instance examination revealed that this was due to distention of the swim bladder and the digestive tract. The latter was devoid of food material and contained only gas and a small amount of bile-like frothy material. Analyses of the bottom organisms revealed than an abundant food supply was available. Dying fish were swimming at the surface (often inverted) in a very lethargic manner, and were easily captured by hand. However, even though they were at the surface, the fish exhibited no gulping action as is noted in case of a respiratory difficulty.

Repeated attempts were made to bring affected fish into the laboratory with the intent of exposing healthy fish from areas where no fish mortality had occurred. Of the numerous fish collected, only four survived more than a few hours, and these recovered completely. Healthy fish held in a tank with the sick fish showed no ill effects.

Extractions with organic solvents were made from bottom muds, and the extracts subjected to infrared and paper chromotography analyses. These techniques offered no clues to possible causes of mortality.

More detailed examination of specimens in the laboratory indicated some degeneration of the intestine or gut, liver, spleen, and kidneys. Bacterial cultures were made utilizing parts of the vital internal organs and the blood of affected fish. The results of these efforts were inconclusive.

Mud samples and fresh water clams were sent to the Robert A. Taft Sanitary Engineering Center in 1960 for analyses for insecticides as a possible cause of the fish mortalities. The results of this phase were negative. Dying fish were frozen and shipped to Dr. S. F. Snieszko, Microbiological Laboratory, U. S. Fish and Wildlife Service, Kearneysville, West Virginia. Fish, clams, and mud samples were submitted to the Patuxent Research Center, U. S. Fish and Wildlife Service, Laurel, Maryland. Again the results of tests were inconclusive or negative.

With the onset of mortalities in late October 1963, efforts to ascertain the cause were renewed and aid of various specialists in selected fields of aquatic biology was enlisted.

Some of the symptoms displayed by the fish were somewhat similar to those that have been noted in abdominal dropsy of fish, a bacterial disease that is often a serious problem in fish hatcheries. Dr. Fred P. Meyer, U. S. Department of Interior, Fish and Wildlife Service, Fish Farming Experimental Station, Stuttgart, Arkansas, checked on possible bacterial or parasitic infestation as a cause of mortality in dying fish collected in the Mississippi River near the Head of Passes. The results of his extensive investigations indicated that disease was not the cause of mortality.

In early December 1963 personnel from the Robert A. Taft Sanitary Engineering Center of the United States Public Health Service, accompanied by personnel from the Division of Water Pollution Control of the Louisiana Wild Life and Fisheries Commission, collected numerous samples of water, bottom muds, fish, and other aquatic forms from several locations in the vicinity of Baton Rouge and the Mississippi River Head of Passes. Critical examination of these materials, along with many other samples collected throughout the months of December, January, and February in the lower Mississippi and Atchafalaya Basins indicated that the probable cause of the mortality was insecticides present in the water in extremely low concentration. The constancy of phenomena in these kills would indicate that the same cause accounted for the kills in the previous three years.

We feel that the site of origin of the problem is in the Mississippi River Basin beyond the Louisiana border. We have noted these chronic winter kills throughout Louisiana's portion of the Mississippi River and that portion of the Atchafalaya Basin receiving flow from the Mississippi, but these areas only. We have received confirmed reports of similar kills as far upstream as Memphis and unconfirmed reports of kills as far upstream as St. Louis. The Mississippi is leveed off in Louisiana with the exception of three small tributaries, draining a total of approximately 400 square miles of non-agricultural woodland, where the use of pesticide is very limited, if not non-existent.

On April 9, 1964, a letter addressed to Dr. G. E. McCallum, Assistant Surgeon General, U. S. Department of Health, Education, and Welfare, Public Health Service, from the Louisiana Stream Control Commission stated in part, and I quote:

> "The purpose of this letter is to officially request technical assistance in gathering more needed data relative to the above-mentioned fish kill. It is, in our judgment, virtually necessary to determine

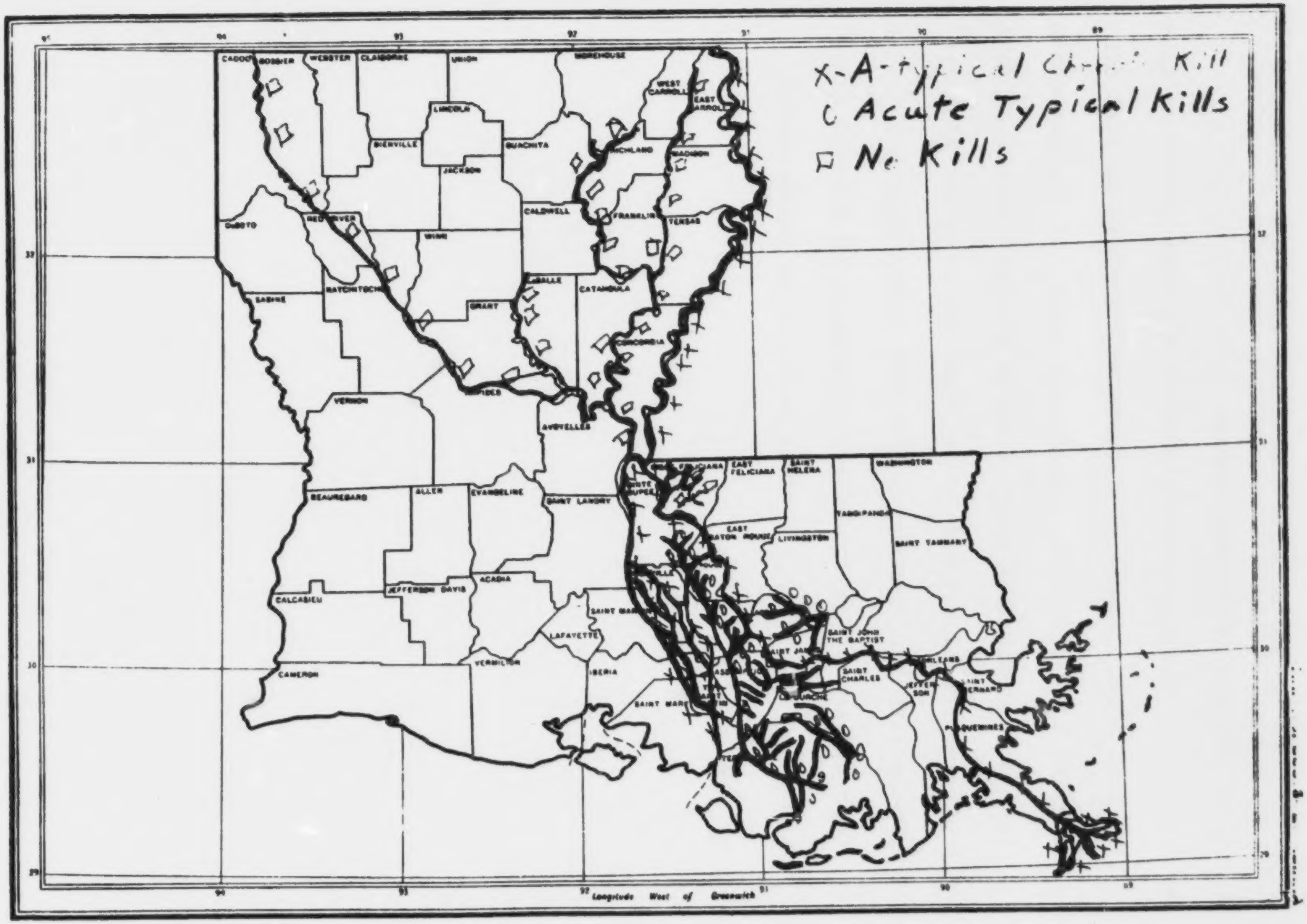
"precisely what the long-term or chronic effect of the toxic synthetic organic materials is on fish and other aquatic life, and also to establish or identify the sources of the materials that are coming into Louisiana's Mississippi River from areas north and upstream from Louisiana. Because it is without question a problem whose solution is beyond the limited capabilities of this State's agency, and because our jurisdiction is restricted to the State of Louisiana, we are requesting this technical assistance with all dispatch at your disposal and/or command."

On April 22, 1964, an answer to the aforementioned letter was received. It was signed by Mr. James B. Coulter, Chief, Water Projects Section, Technical Services Branch, Division of Water Supply and Pollution Control, and stated in part:

"Doctor McCallum has asked me to reply to your letter of April 9, 1964, and to assure you that this division will continue to give Louisiana all technical assistance possible in relation to the fish kill in the lower Mississippi River Basin. We agree with you that this is of extreme importance not only to the Basin but to the Nation as a whole, "and we are seeking additional funds and resources for the necessary studies."

Technical assistance is all that Louisiana asks at this time. However, if there is any basis in fact concerning the identified significant source of contamination from a manufacturing plant located on the Mississippi River upstream from Louisiana, this State will request that the appropriate governmental regulatory agency initiate action to cause the cessation of such discharge to the end that Louisiana's Mississippi River will not be contaminated.

Thank you.


X-A-typical Chronic Kill
○ Acute Typical Kills
☐ No Kills
CADDO
BOSSIER
WEBSTER
CLAIBORNE
UNION
MOREHOUSE
WEST CARROLL
EAST CARROLL
LINCOLN
BIENVILLE
OUACHITA
RICHLAND
MADISON
JACKSON
CALDWELL
FRANKLIN
TENSAS
DeSOTO
RED RIVER
WINN
SABINE
NATCHITOCHES
LaSALLE
CATAHOULA
GRANT
CONCORDIA
VERNON
RAPIDES
AVOYELLES
WEST FELICIANA
EAST FELICIANA
SAINT HELENA
WASHINGTON
POINTE COUPEE
BEAUREGARD
ALLEN
EVANGELINE
SAINT LANDRY
EAST BATON ROUGE
LIVINGSTON
TANGIPAHOA
SAINT TAMMANY
CALCASIEU
JEFFERSON DAVIS
ACADIA
SAINT MARTIN
LAFAYETTE
SAINT JOHN THE BAPTIST
SAINT JAMES
ORLEANS
CAMERON
VERMILION
IBERIA
SAINT MARY
ASSUMPTION
LAFOURCHE
SAINT CHARLES
JEFFERSON
SAINT BERNARD
PLAQUEMINES
TERREBONNE
94
93
92
91
90
89
32
31
30
29
Longitude West of Greenwich

MR. STEIN: Are there any comments or questions?

MR. JONES: We have our old question here on these confirmed reports on fish.

I, in all sincerity, would like to get the confirmation on whether we do or don't have dead fish below Memphis. I am serious on that.

MR. LAFLEUR: I can produce the letter.

MR. JONES: I wish you would trace that back.

MR. LAFLEUR: I will be happy to produce the letter.

MR. JONES: Because I want to find it.

MR. LAFLEUR: Yes.

MR. JONES: But so far Game and Fish hasn't been able to find it.

MR. LAFLEUR: I can let you have a copy of that letter.

MR. JONES: Good.

MR. STEIN: Mr. Wood?

MR. WOOD: In answer to that, I expect you will refer to one of my letters, Bob.

MR. LAFLEUR: Okay.

MR. WOOD: We did not, in the fall of 1963, get any reports. On three previous occasions we did get reports that there were fish kills in the vicinity of Helena, Arkansas.

Our biologist was dispatched, and investigators came back with that information. We did get reports, but we were unable to get any dead fish or observe any and get any samples.

MR. STEIN: Are there any other comments or questions?

MR. JONES: Murray, I wonder about this. This question keeps coming up. Somebody is bound to see some fish. At any rate, we can check with tug boat captains and get names and dates. Some of it will be no good, because it will be from memory now, but we should interview enough people up and down the Mississippi.

Let's find out whether there are fish all the way down or not. If there are, it will help us.

MR. STEIN: Yes.

MR. LAFLEUR: May I comment at this time for Mr. Jones?

MR. STEIN: Certainly.

MR. LAFLEUR: During the past winter, 1963, we repeatedly collected dead and dying fish in the area of St. Francisville, Louisiana, which is well upstream from the Baton Rouge complex. This would be well above any specific areas contributory to the Mississippi River in Louisiana.

Remember, I told you that the Mississippi is leveed off in its entirety with the exception of a little 400-square-mile area.

MR. STEIN: You know, what you have done is raise a very interesting point. You raised some point about reading about this in the papers, just about when I heard about it.

MR. JONES: Yes.

MR. STEIN: But here is what I understand again from the friends I have -- I hope they are friends -- in the press corps in Washington.

They have suggested that we check the newspaper reports on the Mississippi River from Memphis on down. This has been done by some of them on a relatively ad hoc basis. They say that there are reports repeatedly in the papers of reported fish kills.

Now, generally speaking, at the conference stage -- and I hope we don't go beyond the conference stage --

MR. JONES: We won't.

MR. STEIN: At the conference stage, we generally have not gone out and interviewed proposed or potential witnesses on the river, and we try to gather this as we can. However, I think the indication from various reports -- again, we want this confirmed by you people -- is that there seems to be a body of information that rather consistently reports fish kills in the Mississippi River.

A lot of us have been in the water pollution control business and know that we have to look at fish kills or reports from citizens with some care. As you know, my philosophy has always been that if we don't get this confirmed and have the scientific data and the reports of the lay investigators or the lay observers dovetailing, then we don't have anything.

However, I do think that the indications that we have, and this seems to be confirmed by Louisiana, are that there has been a consistent reporting of fish kills in the Mississippi River from Memphis on down. This has been reported in the press, in the papers. A fish kill has to reach some proportions to be newsworthy.

Also, the experience of Louisiana, which has been on top of this and has been looking at this, is that they have found a pattern of consistent fish kills up to the area of their jurisdiction.

MR. LAFLEUR: Since we are talking about newspaper reporting --

MR. STEIN: Yes?

MR. LAFLEUR: Sometime in the early part of March, somewhere between the first and the fifteenth, the

Baton Rouge press picked up an article under a Memphis headline indicating that a Mr. Donald Hinton, if I have gotten the name correctly, with the Food and Drug Administration, had collected fish in the Mississippi River.

I don't assume that he came down to Louisiana to do it, but he picked up fish in the Mississippi River and sent them to St. Louis for analysis.

MR. JONES: Food and Drug?

MR. STEIN: That may be John Hanson.

MR. LAFLEUR: Maybe it was Hanson. I don't know.

MR. JONES: Are the Food and Drug people here?

MR. STEIN: They may have left.

MR. JONES: Should someone then from your office write Food and Drug, or should we?

MR. STEIN: We can check. If this is the man you are talking about, this man is an assistant to the chief in the Washington personnel, but we can check that with Food and Drug.

Just trying to collate the facts, if we can, evidently there have been persistent reports, or there have been reported fish kills from Memphis on down in the press, and that Louisiana has on its investigations found a persistent operation of fish kills.

MR. JONES: The main thing I am trying to do is to cut out a wad of fish hunts, which is like a witch hunt on this.

If there have been any dead fish, if so, someone has seen them. If so, I want to know what dates, so that I can check them, and maybe Associated Press can help us on this.

Ask everybody up there on the river who has seen some dead fish to document to the best of their knowledge the number, the position and the approximate date. You will get some wild reports, but it will form a pattern. We have done that a number of times, and it forms a pattern. Sixty or seventy percent of the data you can pin together. Ten percent they don't know what they are talking about.

We have seen wild turkeys floating down the river from some reports. Seriously, though, I think it would form a pattern.

If we could pin this down to seasons, this would help us tremendously.

MR. LAFLEUR: I have this newspaper clipping in my clipping file.

MR. JONES: I would like you to send me a copy of that, if you will.

MR. LAFLEUR: All right.

MR. STEIN: All right, Mr. Lafleur.

MR. LAFLEUR: The next speaker, Mr. Chairman, is the co-conferee here with me representing the State of Louisiana, but he wants to wear his State Health Department hat. So I would now like to introduce Mr. John Trygg, State Sanitary Engineer and representative of the State Health Department on the Stream Control Commission of Louisiana.

STATEMENT OF JOHN E. TRYGG, CONFEREE AND STATE SANITARY ENGINEER, REPRESENTATIVE OF THE STATE HEALTH DEPARTMENT ON THE LOUISIANA STREAM CONTROL COMMISSION

MR. TRYGG: As Bob has stated, I am principally speaking as a representative of the State Board of Health at this time.

The Louisiana State Board of Health is particularly concerned with the presence of pesticides in our water supply sources and the possible toxicity of these pesticides to humans.

Dr. Strain, President of the Louisiana State Board of Health, has summarized the position of the Louisiana State Board of Health in a letter of March 20, 1964, written to Dr. R. J. Anderson, Assistant Surgeon General, Chief of the Bureau of State Services, U. S. Public Health Service.

Our position has not changed.

Dr. Strain stated:

"The findings of insecticides in the Mississippi River water and in the Mississippi River fish pose a problem which appears to be beyond the capability of the State Board of Health and other State agencies to solve.

The areas in which we need help (and we feel that the Public Health Service is the agency to give us this help) are as follows:

A. Determination of the specific sources of the insecticides found. Although the concentrations seem to increase in reaches of the Mississippi River in Louisiana there is really no drainage to the river from Louisiana soils and there are no Louisiana industries discharging insecticide wastes into the river.

B. Technical assistance in the analysis of water and food samples.

C. Technical assistance in the evaluation of water treatment plant operations to effect maximum insecticide removal.

D. Assistance in determining the toxic level to humans of insecticides. The information needed includes both chronic and cumulative effects."

Dr. Strain concludes this letter with the statement, "Please consider this a formal request to your agency for the earliest possible assistance in solving these and related problems."

We are pleased with the assistance rendered to us thus far by the Public Health Service. Such action included the following: The increased frequency of sampling at the regular water quality network stations and the establishment of new sampling stations, including two in Louisiana, will increase the information available as to general sources of pesticides, although we realize that probably a greater effort would have to be made to determine the exact location of the sources of pollution.

Although the laboratory facilities of the Public Health Service in the area of pesticide determinations are limited, we have received considerable help. It is hoped that a joint State-Federal laboratory can be established to determine levels of pesticides in human tissues, foods, air samples, and finished water, and which will not be in conflict with the facilities operated by our Louisiana Stream Control Commission.

The Public Health Service specialists on water treatment have consulted with us and are presently conducting experimental work at Robert A. Taft Sanitary Engineering

Center to determine methods of pesticide removal in water treatment processes. These specialists have met with the water plant superintendents and operators of our Mississippi River plants to discuss what has been done thus far and to give an indication of what is planned for the future.

In regard to the fourth item, Dr. Anderson has met with Dr. Strain and representatives of his staff, and members of the Tulane University staff of the School of Public Health, which is a medical school, and the Civil Engineering Department, in the matter of studies to determine the toxicity of pesticides to humans.

It is desired that the Public Health Service continue to work with us to answer the pertinent questions on insecticides in the Mississippi River.

In my opinion, essential actions needed at this time include:

1. The determination of the levels of pesticides normally prevailing in our Mississippi River water over the entire calendar year.
2. The determination of the sources of pesticides and the elimination of as many of these sources as practically possible; and,
3. Simultaneously the determination of the toxic levels of pesticides to humans.

I feel that these determinations are esential before we can be absolutely certain that there will be no harmful effects to humans from ingesting Mississippi River water.

MR. STEIN: Thank you.

Are there any comments or questions?

(No response.)

MR. STEIN: If not, do you have anyone else?

MR. LAFLEUR: Yes, I have quite a number of them.

Mr. Chairman, before we go any further, I would like to recognize Dr. Richard Gregg, who ably assisted me here in the preparation of the statements which you heard just a minute ago, in indicating on the map those areas that I referred to in the statement.

The next speaker is Dr. Lyle S. St. Amant, Chief of the Seafood Division of the Louisiana Wild Life and Fisheries Commission.

Dr. St. Amant.

STATEMENT OF DR. LYLE S. ST. AMANT, CHIEF, SEAFOOD DIVISION, LOUISIANA WILD LIFE AND FISHERIES COMMISSION

DR. ST. AMANT: Mr. Chairman, conferees and ladies and gentlemen:

Before I make this statement, I would like to explain my position. I am Lyle S. St. Amant, Chief of the Seafood Division, Louisiana Wild Life and Fisheries

Commission.

The statement I am making is essentially the opinion of the Louisiana Wild Life and Fisheries Commission based on the information available at the time that this was prepared.

This is essentially the same statement that we presented to the agricultural hearing in Baton Rouge on April 16th, and it will probably remain the general consensus of the Louisiana Wild Life and Fisheries Commission with respect to pesticide pollution and general pollution until such time as we are able to get more detailed information.

The statement will be presented as written.

The Louisiana Wild Life and Fisheries Commission submits this brief statement today because it is charged by law with the guardianship, administration, and management of a multimillion dollar commercial fishery and an equally important and valuable recreational and sport fishery. Needless to say, this Commission and the thousands of citizens it represents have become gravely concerned over the recent detection of certain extremely toxic insecticides in the Mississippi River and its distributaries. While at this time it is much too early to assess the extent of the problem with which we are faced, its ramifications, including possible basic changes in bio-ecology, fishery production, health problems and the regulation of pesticides stagger the imagination.

Basically our concern as a conservation agency deals only with the effect of such toxic materials on the animals themselves, the basic environment supporting the fishery, and on total fishery production. Lest it be assumed that the importance of protecting the fishery production is overemphasized, it should be pointed out the total value of the commercial fishery in Louisiana ranges from $75 million to $100 million annually, and furnishes a livelihood for 50,000 or more citizens. Statistically Louisiana produces over 1 billion pounds of menhaden, 80 million pounds of shrimp, 10 million pounds of oysters, 15 million pounds of fresh water commercial fish, 5 million or more pounds of crayfish, and several million pounds of salt water fish and crabs. It is evident that the value of the commercial fishery in Louisiana both as a food source and economically is equivalent to many important agricultural crops in the State.

Turning to recreational and sportfishing, one tends to find the uninformed frequently less concerned and willing to sacrifice this segment of the natural resources for the sake of well established industries of economic importance. Nevertheless, the economic value of the recreational fishery to the State may equal or exceed the value of the commercial fishery. Nearly 1 million citizens fish and spend considerable sums of money in pursuit of their hobby. Furthermore, the millions of pounds of fish caught in this manner form a significant part of the food supply of the State.

Perhaps some will want to question the inclusion of salt water fish in the present problem, but failure to do so would be the height of folly from a fish management standpoint. Louisiana stands first in fishery production in the northern Gulf because of the Mississippi River and its vast estuary. It is axiomatic among marine biologists that this great river not only is the prime cause of the fantastic fishery production in Louisiana, but also it is largely the basic reason that the entire northern Gulf produces 31% of the total fishery production of the United States. Since a high percentage of river water is needed to maintain the moderate salinities in the estuarine nursery areas, permanent and continuous pollution of this great fresh water source could prove disastrous to fish production in this area. All of the marine species making up the fishery products of Louisiana spend some part of their life cycle in the nursery area of the estuary, usually during the larval or juvenile stages when they are most susceptible to minimal toxic levels of pollution.

While it is evident at this early stage of investigation that many questions can be posed with few answers available, it is essential that the problem be assessed and faced. Following are some of the facts that are known and some of the more obvious questions that must be answered before unrestricted use of insecticides on the watershed of the Mississippi River can be unconditionally accepted:

1. It has been established by laboratory and controlled field experiment that fish, crustacea (including shrimp, crabs, and crayfish) and the various minute plankton forms forming the food chain are extremely sensitive to most of the chlorinated hydrocarbons. Concentrations of Endrine, Lindane, or Heptachlor as low as 0.3 - 0.4 ppb. resulted in 50% mortalities in 48 hours, while DDT, Chlordane, Toxaphen and Dieldrin are lethal at levels of 1-6 ppb. (Butler and Springer, 1963).

2. Adult oysters are less sensitive to insecticides with respect to mortality rates, but the growth rate is reduced by 50% in concentrations of 7 ppb to 0.5 ppm. Of more serious consequence is the fact that mollusks tend to concentrate these toxic materials in their tissues.

3. Possibly the most serious question and one

which will take some time to answer is the total effect of minute levels of toxic chemicals on the sensitive eggs, larval forms, reproduction efficiency, and tiny food chain organism. Since proper function and interrelationship of all of these biological activities are necessary to maintain life and production of a species, a break in the weakest link in the chain would decimate or eliminate a species. Evidence is now on hand to indicate that only traces of many insecticides will destroy shrimp, oyster and fish larvae. Fish eggs containing insecticide fail to hatch, or the fry die immediately after hatching. Little if anything is known of the effects of trace levels of insecticide toxins or plantonic forms making up the base of the food chain. Many of these forms are microscopic and may be extremely sensitive to toxins or, conversely, may be resistant and concentrate the chemicals only to kill large animals when consumed as food.

4. Arguments will probably wax and wane for some time concerning the amounts of insecticides entering our river systems and estuaries, and whether or not the levels are sufficiently high to be dangerous. Nevertheless, it seems unrealistic to assume that insecticides and other pollution products can be continuously added

to our water systems year after year without expecting disastrous effects sooner or later. Already it has been demonstrated by the United States Public Health Service that since 1957 most of the major river systems in the United States contain measurable amounts of insecticides. The chlorinated hydrocarbons are known to persist for long periods of time, even as much as ten years. (Lichtenstein and Polivka, 1959). Who is to say that bottom muds of rivers and estuaries will not in time become contaminated with unacceptable levels of toxic chemicals? And who can tell how long they will remain contaminated even if the source of pollution was eliminated?

We believe that the recent massive fish kills in the Mississippi River and its estuary attributed to Endrine and other pesticides portends things to come. While there has been no reported kills of shrimp, this is not surprising. Millions of adult shrimp can die and never be seen, and the mortality of larvae would only be reflected in a decimated harvest of adults. These things we do know and cause grave concern. Insecticides have been detected in the Mississippi River and its delta area. Fish kills of marine species have been reported in the delta area. Speckled trout, flounder and other species formerly occurring in great numbers in the passes of the river at low water stage have all but disappeared in the past four years. Shrimp production averaging 80 million pounds annually from 1939 to 1956 suddenly has become extremely cyclic for no obvious reason since 1957. During the past six years, excepting 1963, production has been down and during two years reached lows of 30 million pounds. Reduced production has been associated with high rainfall years and high river stages. The one normal year out of six, 1963, occurred in a drought period of low river flow. At present we do not know the answer to this puzzle, but our shrimp research program is rapidly being geared to determine the relationship between river water and shrimp production.

In conclusion, it is assumed that since this hearing deals with possible changes in regulations, or the control of pesticides and pollution, that some constructive suggestions for the improvement of present conditions should be made.

This is a difficult task from our point of view because we are not familiar with the mechanics of pesticide regulations. Our position on such matters would be to request of the proper regulatory agency to take whatever steps are necessary to eliminate or reduce the present levels of insecticides to a point where they will pose no future danger to fish and wildlife and to establish and maintain such safeguards as are necessary to prevent future excessive pollution of water supplies. We feel that the extensive fish kills since 1960 clearly point to a condition of excessive pollution and we can expect continuing and perhaps greater fish mortalities in years to come if some action is not taken. Other ramificiations of insecticide contamination in the river are only now being intensively investigated and all indications point to the fact that more problem areas will occur if corrective action is not taken.

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MR. STEIN: Thank you, sir.

Are there any comments or questions?

(No response.)

MR. STEIN: Will you just stay there for one moment, if you will?

DR. ST. AMANT: All right.

MR. STEIN: Dr. St. Amant, I think you have pointed out something here that I think we should all take into account.

Here is someone at the other end of the line -- as a matter of fact, at the end of the line. We have to take into account the preservation of the welfare of this country and its States, to protect the population of fish and wildlife. I think we realize how close we may be to the brink.

I just put this to you: I know Mr. Trygg is standing here, as are probably the people of Louisiana, expecting that there will be a certain measure of safeguards in protecting the water supplies of their cities, such as Vicksburg and New Orleans and other cities, as we protect the milk supply.

I suggest what Dr. St. Amant has pointed out, that we may not or should not permit ourselves to come very close to the brink, or play Russian roulette with the seafood shellfish industry in the Gulf area, and down in the Lower Mississippi, and some of us only know how close that is.

Now, I think that this has to be balanced in the same sense that we have to have a safeguard for our water supplies. In the same sense that we have to have a viable and productive agriculture, we also have to understand on balance that we have one of the greatest of our national resources here in your fishing and shellfish industry.

I don't think there is any element of New Orleans that is more attractive as a tourist attraction than the seafood.

Off the record for a moment.

(Discussion off the record.)

MR. STEIN: Fish is the kind of resource that you have down in the Gulf States, particularly around New Orleans, that is priceless and should be preserved.

Do you have any comment, Dr. St. Amant?

DR. ST. AMANT: I have no comment.

MR. STEIN: Thank you very much.

MR. LAFLEUR: My next speaker, Mr. Chairman, is Mr. Richard Carlton, State Entomologist, Louisiana Department of Agriculture.

STATEMENT OF RICHARD CARLTON, STATE ENTOMOLOGIST, LOUISIANA DEPARTMENT OF AGRICULTURE

MR. CARLTON: I might not have the best testimony, but I do have the shortest testimony.

Mr. Chairman, I am Richard Carlton, State Entomologist with the Louisiana Department of Agriculture and Immigration. I am representing that Department and Dave L. Pearce, Commissioner of Agriculture. I wish to state that we are in complete agreement with the testimony being presented at this hearing by Dr. L. D. Newsom, representative of the College of Agriculture of Louisiana State University.

MR. STEIN: Thank you, sir.

(Discussion off the record.)

MR. LAFLEUR: My next speaker, Mr. Chairman, is Dr. L. D. Newsom, head of the Department of Entomology, Louisiana State University.

STATEMENT OF DR. L. D. NEWSOM, HEAD OF THE DEPARTMENT OF ENTOMOLOGY, LOUISIANA STATE UNIVERSITY

DR. NEWSOM: Mr. Chairman, members of the conference, ladies and gentlemen:

I had planned to start this presentation by making a recommendation, but I am afraid I would be taken up on it. I had planned to recommend that this conference be broken off, that we go back and as intelligent scientists get enough information together to make such a conference worthwhile.

I think the testimony that has been presented at this conference during the last two days would abundantly support the need of this sort of a procedure.

My name is L. D. Newsom. I am the head of the Department of Entomology, Louisiana State University. I represent the College of Agriculture, Louisiana State University, at this hearing. Much of the evidence which I have on the problem was presented at the Department of Agriculture hearings in Washington April 9 and in Baton Rouge April 23, 1964. To save time, I should like to place copies of these two documents in evidence without additional discussion except for especially pertinent points.

MR. STEIN: Without objection, they will be received and made a part of the record.

DR. NEWSOM: Thank you.

The discovery, development, and putting into practice of new machines, new chemicals and new processes have often been attended by undesirable side effects. History provides many examples of this. Nuclear power, agricultural chemicals and automation provide three of the most recent examples of this fact.

Fortunately, it is never possible to know what the eventual side effects may be of the adoption of a new process or use of a new machine. If this were possible progress would probably come to a stop. For example, had it been known at the turn of this century that use of the automobile would result in the number of deaths and injuries that occurred in the United States as a result of automobile accidents during 1963, legislation probably would have been passed making it a capital offense to develop such a machine. In spite of the adverse side effects of their use, few would argue for automobiles being taken off the market today.

As for detrimental effects on wildlife species, the plow and the saw have been by far the most disruptive tools ever invented by man. Yet, no one would argue that these tools should be removed from the market.

Only the lunatic fringe would argue today that use of commercial fertilizers should be prohibited. Nevertheless, commercial fertilizers have their adverse side effects also. For example, a discussion of safe water supplies by Dr. Gordon M. Fair at the Fifth Annual Scientific Conference on Environmental Factors in Public Health held at Albert Einstein College of Medicine, New York, May 27, 1963, was summarized in part as follows in Public Health Reports, Volume 78, September, 1963: "Still others are chronic, such as nitrates from fertilized soil, posing the threat of methemoglobinemia to infants given water from shallow wells ...."

"A particularly startling prospect in pollution, Fair noted, is the eutrophication of ponds and lakes, promising eventual destruction even of the Great Lakes, if the process is not reversed. In effect, the phosphates used as fertilizer drain from the fields into impounded waters where they support the growth of diatoms whose skeletons eventually choke and fill the basin. When they die, they yield the phosphorus to water for new growths, supplemented by the annual increment drained from the fields."

Pesticides used in Agriculture and Public Health probably have been criticized more violently than all other chemicals combined, and there has been considerable justification for this. Many highly undesirable side effects result from the use of these materials. Among these the most important are 1) destruction of beneficial forms including insect predators, parasites, and pollinators, fish and other forms of wildlife, 2) acute toxicity hazard to man and his domestic animals, and 3) the possible hazard to man and wildlife resulting from the contamination of the environment, including food and feed, with trace amounts of many of these chemicals. Continued use of such chemicals can be defended only if benefits from their use outweigh undesirable side effects.

As a result of technological advances in analytical methods it has become obvious that many insecticides can no longer be used on the basis of "no residue" or "zero tolerance." The unrealistic nature of these concepts has been aptly described by Mr. George P. Larrick, Commissioner, Food and Drug Administration, Department of Health, Education, and Welfare, in his testimony before the Ribicoff Committee hearings. No further comment is needed.

At this point, I should like to turn to Page 7 of my April 23 presentation and enter into the record again a quote from Mr. Larrick at the Ribicoff hearings. This quote will come from the testimony of Mr. George P. Larrick, Commissioner of Food and Drug Administration, as given in Volume 16 of the U. S. Senate Report of Proceedings, hearing held before Subcommittee on Reorganization and International Organizations of the Committee on Government Operations, Environment Hazards, Control of Pesticides and Other Chemical Poisons, April 8, 1964. I should like to quote the following from that document:

> "Senator Ribicoff. Well, what if milk had the same amount of endrin as there is in the New Orleans water supply? Could you detect it?
>
> "Mr. Larrick. Not by that method. The method that was used by the Public Health Service, as I understand it, could detect these parts per billion of endrin in the city water supply -- involved taking 5,000 gallons of water, running it through charcoal, where the endrin is concentrated in the

"charcoal, and then taking the charcoal and analyzing it.

"Now, we could not, as a practical matter, in analyzing milk, take 5,000 gallons of milk and run it through charcoal. It just wouldn't be practicable to do it.

"Senator Ribicoff. Well, let's leave milk.

"Suppose you had jurisdiction over water, and you found that much endrin in water. What would be your attitude?

"Mr. Larrick. I would think actually that that would be pharmacologically insignificant."

Page 1242.

"Senator Ribicoff. When it came to endrin in fish, how much would you require before you forbade it to go in interstate commerce?

"Mr. Larrick. Well, the limits of the analytical method, which would be in the range of 0.5 parts per million."

Page 1237.

"Mr. Larrick. Let me say this: When the original pesticide law was passed, and the zero tolerance was included, the methods of analysis that we had were far less able than they are today.

"Later, when Congress considered the same questions with respect to food additives, and with respect to color additives, the Department and we did recommend that the type of zero tolerance which is included in the pesticide law, is unrealistic, and unworkable. And we recommended, and the Congress acted upon the recommendation that the statue provide that the tolerance be zero when determined by a method of analysis chosen by the Food and Drug Administration.

"I do think that the zero tolerance in this pesticide law, as it stands, does not make good sense.

"Senator Ribicoff. Well, what does make sense? What do you think makes sense?

"Don't you think -- what do you think makes sense?

"Mr. Larrick. First, in all instances where it can be done, I think the whole question should go through the tolerance-making procedure and a finite tolerance should be set.

"Senator Ribicoff. On milk, too?

"Mr. Larrick. Yes, on milk, too."

L. D. Newsom

The importance of pest control in agriculture is often unappreciated in a country where food and fiber is in surplus. The necessity for conserving food in the face of an exploding population in a world where already at least one-third of the population is inadequately nourished is one of the most important problems facing man. Recent estimates of world population trends prepared by a special panel of the National Academy of Science (Public Health Reports, Volume 78, 1963) are summarized as follows:

> "At the present rate of increase, the world population will double every 35 years, producing a population of 6 billion by the year 2000 and about 25 billion by the year 2070. Such rapid population growth, which is out of proportion to present and prospective rates of increase in economic development, imposes a heavy burden on all efforts to improve human welfare."

Dr. Nevin S. Scrimshaw, head of the Department of Nutrition, Food Science and Technology at the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas, February 4-20, 1963, Geneva, Switzerland, stated that -- Mr. Chairman, I seem to have left out that this is the California Institute of Technology where this is located:

> "Conservation of food begins with use of chemicals in the field to prevent losses from insects, fungal and viral plant pathogens, and premature dropping of fruit." (Public Health Reports, Volume 78, 1963).

The role of insecticides in public health is often taken for granted or ignored. Their importance in this area is summarized in the following statement by R. J. Hammerstrom:

> "Some of the major achievements in public health since 1944 have been realized through the use of newer insecticides, beginning with DDT. Important vector-borne diseases, such as malaria, typhus fever, yellow fever, and insectborne enteric infections have been controlled effectively in certain parts of the world and virtually eradicated in others through the use of insecticides. In the United States, for example, malaria is considered to be near eradication; endemic typhus fever morbidity has fallen from a peak of 5,041 reported cases in 1944 to an alltime low of about 100 cases annually. These phenomenal achievements in this country and elsewhere are attributed for the most part to the use of DDT."

The need for insecticides in combating human disease has been emphasized in the following statement by

Mr. M. G. Candau, Director General of the World Health Organization:

> "In a rather different direction, we are assisting applied research by arrangements under which the manufacturers of promising new insecticides may have their products assayed and tested in laboratories designated by WHO. With the help of the National Institutes of Health, Public Health Service, some progress has been made with this scheme, which should materially reduce the interval between the discovery of a new insecticide and its use in the field." (Public Health Report 73, 1958).

On the other side of the ledger, use of these pesticides has destroyed insect predators and parasites to the extent that a number of minor and secondary pests have assumed primary importance, killed fish, birds and other wildlife species, and contaminated the environment generally with minute but measurable residues. It has been known for some time that small amounts of many insecticides may be found in human fat. Results of a recent study by Dale and Quimby of the United States Public Health Service (Science 142:593-595, 1963) showed small amounts of BHC, Dieldrin, DDT and DDE in samples of human fat collected during 1962-62 in Wenatchee, Washington, Phoenix, Arizona, and Lexington, Ky.

Such undesirable side effects have been the basis for numerous predictions of the imminent destruction of not only many forms of wildlife but the human race as well. The record after almost 20 years of use of DDT, and more than 10 years of use of the three insecticides responsible for this hearing does not provide any basis for such fears. If human health has been affected, the effect must have been a beneficial one. According to Public Health Reports, Volume 77, p. 974, 1962, "Life expectancy for Americans at birth has for the first time passed 70 years; the estimate for 1961 was 70.2 years."

Similarly, there is no evidence of any permanent effect on wildlife. For example, the mourning dove which is closely associated with agriculture shows a tremendous increase in population during the last 10 years according to U. S. Department of the Interior, Fish and Wildlife Service, Special Scientific Reports 70 and 73. Likewise, populations of the red-winged blackbird, another species closely associated with agriculture, has increased to the point that it has become a major pest. The fact that wildlife is at peak populations in Louisiana was documented in recent articles by Mr. L. D. Young, Jr., Director, Louisiana Wildlife and Fisheries Commission (Times Picayune, New Orleans, Louisiana, January 26, 1964, and 10th Biennial Report, Louisiana Wildlife and Fisheries Commission, p. 7).

L. D. Newsom

The Mississippi River has often been called, and probably with considerable justification, a large sewage ditch. It is known to be contaminated with several types of pollutants which can be toxic to fish.

According to the 10th Biennial Report, 1962-1963, Louisiana Wildlife and Fisheries Commission, "The Mississippi River receives both treated and untreated industrial waste discharges from a number of industries from St. Francisville, Louisiana, to below metropolitan New Orleans, Louisiana. Considerable quantities of untreated municipal wastes are also being discharged to this river..."

Contamination of shellfish by various chemicals is well known. For example, an article in Public Health Service, Drinking Water Standards 1962, p. 25, calls attention to the fact that shellfish and crustaceans may contain up to 170 p.p.m. arsenic. The tolerance set by Food and Drug Administration for arsenic on fruits and vegetables is 3.5 p.p.m. of arsenic, but estuary water, contaminated with industrial effluents,may contain from 0.14 to 1 p.p.m. Is contamination of this sort any less important than that by chlorinated hydrocarbons?

Contamination of oysters by oil is a common complaint of oyster farmers. The following statement on this subject was made on p. 209, 10th Biennial Report 1962-1963, Louisiana Wildlife and Fisheries Commission:

> "About 13 percent of complaints brought to the Commission by oyster farmers of the coastal waters is because of oily taste in oysters. Evidently, for several years drilling muds bearing middle distillates were disposed of by contractural well service operation. These oil bearing muds lay dormant as the oil slowly leached out into the coastal waters; but the expanded estuarine waters now unavoidably churn the mud causing a more rapid dispersion of sediment by lunar currents and tides, etc."

The only extensive study on the effects of chronic toxicity of Endrin to fish available thus far is that by Dr. Donald I. Mount (U. S. Department of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, Research Report 58, 1963). There is much in this publication which is pertinent to this hearing. However, before quoting any of this material I should like to attempt to clarify a statement attributed to Dr. Mount which has been widely quoted in the press. I believe he was misquoted in the statement attributed to him to the effect that three drops of Endrin in the Potomac River would kill all the fish in it. Otherwise such a statement would indicate gross irresponsibility, and I would not choose to quote any data he might publish. No scientist would have made such a statement without having first checked stream flow data for the Potomac River. Having done so, he would have found that three drops of Endrin in the Potomac River at most could amount to only 1 part in several trillions. Dr. Mount would have known from his studies that the bluntnose minnow would not be affected by Endrin even at concentrations as high as 0.25 p.p.b. He also would have known that this species probably occurs in the Potomac River since its distribution, in part, is given as follows: "Widely distributed from southern Canada, throughout the Great Lakes region, to southern Quebec and Lake Champlain and southward on the Atlantic slope from New York to the James River system of Virginia..." (Blair, Blair, Brodkorb, Cagle, and Moore. p. 137, 1957). Therefore, I feel sure that he would not have made such an irresponsible statement.

In his discussion of the results of his studies of chronic toxicity of Endrin to the bluntnose minnow, Dr. Mount made the following points:

> "The high growth rates of those fish in 0.1 p.p.b. stand out as the most significant difference in table 5. This growth was greater than that of the controls, and began very early in the test period. Fish were not measured during the test period because of the

"danger of injury. Unfortunately, all the fish in 0.1 p.p.b. were males, and the higher growth rate may be due to this fact. It is true, however, that the females grew more than the males in one out of three chambers in which both sexes were present. This is an indication that the large length-increase in 0.1 p.p.b. Endrin was not attributable to the fact that all were males. One might postulate many reasons for this growth rate, but the significant point is that these fish were able to grow in 0.1 p.p.b. Endrin and, as will be pointed out later, showed some indication of reproductive activity.

The fish in 0.1 p.p.b. Endrin appeared to be healthy, and behaved in a normal manner. They fed readily as soon as food was introduced. When they were examined after being killed, there were many fat deposits, especially around the abdominal cavity. These fish were much fatter than any of the other fish tested, including the controls. Whether there was any relation between this growth and the Endrin is not known. This effect should be tested further with a larger number of fish.

One male in 0.4 p.p.b., one in 0.1 p.p.b. and one in the control group had spermatids in the testes and "moderately well developed tubercles on the head. The other males had both primary and secondary spermotocytes in the testes. Fighting was common among the males in 0.1 p.p.b., indicating sexual activity.

All the females had ovaries in a state of maturity comparable to fishes taken in the streams. Several females in TB-6, TB-7 and CB-10 showed distention of the abdomen resulting from ovarian development. It appears, therefore, that Endrin in concentrations of 0.5 p.p.b. or less will not affect gonadal development in individuals which can tolerate such concentrations...

Endrin does not appear to be cumulative in its effect on fish subjected to chronic exposures. There was a narrow range from 0.4 to 0.5 p.p.b. in which fish showed some loss of weight and greatly increased activity. No effect was found below this concentration. Although no reproduction occurred in the bluntnose minnow, the gonadal development indicated that reproduction might have taken place if the test had been continued. Concentrations as low as 0.5 p.p.b. appeared to prevent reproduction in guppies."

L. D. Newsom

I should like to make a comment about these guppies. I believe Dr. Mount has discounted his data on guppies because of the presence of disease in his tests, so that would not apply.

> "It appears that the increase in activity caused by endrin in concentrations of 0.5 and 0.4 p.p.b. might be of greatest significance in natural populations through disruption of spawning behavior and displacement from their normal habitat niche.
>
> "On the basis of the data, endrin appears to enter the body through the intestine as a result of the fish's drinking water. Very young fish are resistant to endrin, probably because their mouths are not functional and the endrin does not get into the intestine.
>
> "There is evidence of a slight accumulation of endrin in carp tissue during a 28 day exposure. The low concentration found in muscle tissue would probably not be harmful to human beings eating exposed fish. Cooking would also reduce the concentration.
>
> "It appears on the basis of this investigation that endrin would not harm fish seriously so long as a concentration which is not lethal in 30 days is

"not exceeded. Endrin is extremely toxic to fish, and application rates would have to be very low. However, if endrin will effectively control pests at an application rate which would be safe for fish, its use would be preferable to that of a compound less toxic to fish but with greater cumulative effects.

"There is a very serious need for chronic-toxicity studies of the effects of many insecticides on all aquatic forms. Not one such study was found in the literature. Investigations are needed to determine which organisms in the aquatic food chains are most sensitive to various pollutants. More work should be done to determine the residual life of these pollutants in the bottom sediments and in the tissues of animals. Until this information is known, the danger involved in continuous use of insecticides cannot be determined. There is little knowledge at the present time to indicate what danger there is to human beings, either directly or indirectly, from continuous use of insecticides.

"Finally, it will be necessary to gain a better understanding of normal fish physiology before the true danger of insecticide to fish can be properly "assessed."

Dr. Mount's conclusions that there is little knowledge presently available to indicate what danger there is to either humans or fish are certainly valid. Unfortunately, there has been little done since his report appeared to add to knowledge on the subject. The following discussion of fish kills in Louisiana is quoted from a section on the subject, p. 211, 10th Biennial Report, 1962-1963, Louisiana Wildlife and Fisheries Commission, dated May 1, 1964.

> "The Division of Water Pollution Control has again during the past two years investigated numerous fish kills attributable to both natural and man-made factors.
>
> "Most of the natural kills and several of those attributable to man's activities were caused by depletion of dissolved oxygen. In the natural kills most of the oxygen depletions have been brought about by plankton blooms or accumulation of plant detritis along with low water levels and high water temperatures. Most of the man-made oxygen depletions were caused by discharges of waste from food processing plants, particularly sweet potato canners, during the late summer and early fall.
>
> "Foremost among man's activities contributing

"to fish mortalities is the widespread use of insecticides, particularly the application for the cane borer control. Fortunately the kills from insecticides have been less numerous during the insecticide application season.

"Louisiana continues to be plagued by sporadic kills during the cool water months. These kills show a rather consistent pattern that closely resembles that of the massive kill noted in the Atchafalaya system and the Mississippi River during the winter of 1960-1961. None of the subsequent kills have reached such massive proportions. However, there are two additional causes for concern that have been noted in other streams in the Florida Parishes as far east as the Pearl River: (1) the kills this year have been noted earlier in the year (mid-October vs. mid-November) and, (2) at higher water temperature (20°- 22°vs. below 15° C.).

"In addition to the running of analyses in the division laboratories, numerous samples of water, bottom muds, food organism, and fish have been sent to the following organizations: Robert A. Taft Sanitary Engineering Center, U. S. Public Health Service, Cincinnati, Ohio; Microbiological

"Laboratory, U. S. Fish and Wildlife Service, Kearneysville, West Virginia; Patuxent Research Center, U. S. Fish and Wildlife Service, Laurel, Maryland; and Fish Farming Experimental Station, Bureau of Sport Fisheries and Wildlife, U. S. Fish and Wildlife Service, Stuttgart, Arkansas. These materials, when analyzed in the various laboratories have shown presence of insecticides at very low or even insignificant levels in a small percentage of the fish examined. In addition, bacteriological examination has disclosed presence of bacteria belonging to known pathological groups in some, but not all, of the fish. It is hoped that in the continued studies some definite evidence of the cause of these mortalities will be found.

"Additional minor kills have been noted that were due to thermal shock, toxic algae blooms, industrial discharge of toxic materials, and some easily discernible fish diseases. However, none of these have reached the alarming proportions of some of the kills attributed to insecticides or the widespread mortality of unknown origin."

Data presented thus far do not prove that contamination of the Mississippi River by agricultural use of

Aldrin, Dieldrin, and Endrin is responsible for any of the reported fish kill, or contamination of fish and shellfish with unacceptable residues of these pesticides. The following questions illustrate the need for much additional data on this problem.

1. Why do the fish kills in the Mississippi and Atchafalaya Rivers which are attributed to Endrin differ so completely from the so-called "acute" kills known to occur occasionally in the sugarcane area as a result of the contamination of water with Endrin applied for sugarcane borer control?

2. If Aldrin, Dieldrin and Endrin are responsible for these kills in Louisiana, why have they not occurred in the Red, Tensas and Black Rivers and other streams of the Atchafalaya Drainage Basin above the Old River connection with the Mississippi River? These streams drain vast areas which have been intensively treated with these insecticides for more than ten years. In spite of this the following statement appears in the 10th Biennial Report, 1962-1963, Louisiana Wildlife and Fisheries Commission, p. 204, "Smaller streams such as the Black and Tensas rivers and other rivers are relatively free of pollution and provide an excellent quality of sport and commercial fishing."

In connection with the tributaries here, I would be curious to know what line of reasoning led to Mr. Krause's conclusion, and I quote this from Page 2:

> "The results from samples taken of mud and water from tributary streams were essentially negative. This was expected because major applications of Endrin to farmland are not made during winter months and streams draining farmland were near flood stage during this period of sampling."

I am curious to know how this could differ from other rivers, differing only in size?

3. If Aldrin, Dieldrin, and Endrin are responsible for these kills why did they not occur prior to 1960? Use of these materials has declined drastically during the last several years in much of the area which drains into the Mississippi River.

4. Why have the kills not been continuous if they are the results of accumulating lethal doses of these insecticides from continuous exposure to minute amounts?

5. Why have these kills occurred only during late fall and winter months? Runoff with attendant transport of insecticides from treated fields should deposit more insecticides into streams during periods of heavy use in the summer months. Also, the toxicity of Aldrin, Dieldrin and Endrin is greater at high than at low temperatures.

6. How could it be possible that these insecticides entering the Mississippi River north of Vicksburg fail to kill at least as many fish north of Baton Rouge as south of this location?

7. Why has no mortality been observed in Bayou Lafourche while according to the U. S. Public Health Service Report, p. 11, it receives almost its entire flow as water pumped from the Mississippi River?

8. How could 9 of 20 buffalo collected from the river in early February 1964 show no measurable amount of Endrin in the blood if these animals were exposed to an environment which one would expect to be relatively uniformly contaminated by a pollutant introduced at least 100 miles upstream?

9. Why does the response of fish being killed in the Mississippi River differ so markedly from the response of bluntnose minnow to chronic levels of endrin.

The position of the College of Agriculture, Louisiana State University, is that the agricultural use of any insecticide, or group of insecticides, must be discontinued if such usage involves a hazard to human health or permanent damage to wildlife populations. However, it is also our position that it should be established without reasonable doubt that such hazards are involved before any action is taken which would result in withdrawal from use, or which would impose severe restrictions upon the use of any insecticide. Until satisfactory answers can be supplied to the above questions we do not believe that any action to impose additional regulations on use of Aldrin, Dieldrin, and Endrin can be justified, and we recommend that none be taken.

(Additional documents submitted by Mr. Newsom are as follows:

STATEMENT OF L. D. NEWSOM

HEARINGS ON ALDRIN, DIELDRIN, AND ENDRIN
BATON ROUGE, LOUISIANA
APRIL 23, 1964

Mr. Examiner, Ladies and Gentlemen: My name is L. D. Newsom. My home is at 5064 Perkins Road, Baton Rouge, Louisiana. I am Head of the Department of Entomology, Louisiana State University and I represent the College of Agriculture at this hearing.

The fact that insects and related pests must be controlled in order to maintain an adequate supply of food, feed, and fiber for an exploding population and to protect the health of man and his domestic animals is not debatable. Neither is the point debatable that aldrin, dieldrin and endrin are excellent tools for use in combating many of our most important pests. They have been used successfully for this purpose in Louisiana for more than 10 years. In spite of this long history of successful use, no evidence has accumulated to indicate that their normal agricultural usage constitutes any hazard to human health.

At this point I should like to place in evidence Louisiana Insect Control Guides for 1964 which show a total of 30 recommended uses of aldrin, dieldrin and endrin for control of various agricultural pests. Although substitutes are available for some of the uses for which these materials are now employed, there are no effective substitutes available for some of them. For example, should use of aldrin be eliminated no effective material would be available for control of the rice water weevil, Lissorhoptrus oryzophilus (Kuschel) and the grape colaspis Maecolaspis flavida (Say). These important rice pests are currently controlled very effectively by treating seed rice with aldrin at the rate of one-fourth to one-half pound per hundred pounds of seed. The protection given to the crop by such treatment results in increases in yields of 300-500 pounds per acre.

L. D. Newsom

If growers should no longer be permitted to use dieldrin for control of the sweet potato weevil, Cylas Formicarius elegantulus (Summers), wireworms Conoderus spp. and white grubs Phyllophaga spp., there would be a catastrophic effect upon sweet potato production. This important crop is already in serious difficulties in some sections of Louisiana because of the damage being done by these pests.

Endrin has provided sugarcane growers with the first really effective insecticide for control of sugarcane borer Diatraea saccharalis (Fabricius). The same statement may be made in the case of the southwestern corn borer Zeadiatraea grandiosella (Dyar). Although Guthion and Sevin are available as possible substitutes for endrin, they are not as effective, they would have to be applied at rates so much higher than necessary for endrin that much of their potential advantage from comparatively lower toxicity to fish and other forms of wildlife would be lost, and they are about three times as expensive as endrin.

In spite of the handicaps which would be imposed upon the public by cancellation of approved uses, or the imposition of severe restrictions upon their use, we take the uncompromising position that such steps must be taken if hazard to human health or permanent damage to fish and wildlife populations can be demonstrated. Data presented thus far do not demonstrate the need for modifying currently accepted agricultural use of any of these materials.

In the case of wildlife it has been widely predicated in some quarters that many species were in serious danger as a result of exposure to insecticides. The facts do not seem to support any cause for alarm. For example, in the January 26, 1964, issue of the New Orleans Times Picayune an article by Mr. L. D. Young, Jr., Director of the Louisiana Wildlife and Fisheries Commission bears the caption "Wildlife Resources Hit Peak". Reference in this article to shrimp production in Louisiana during 1963 is especially pertinent, "The 1963 shrimp season was an exceptional one. Louisiana's total production was over 90 million pounds, heads-on weight. This made the year's production equal to the greatest year on record, putting Louisiana back in first place as a producing state".

The woodcock furnishes an especially interesting example of apparently unfounded fears of damage to a species as a result of exposure to insecticide residues. Because a relatively large percentage of the total North American population of this bird winters in Louisiana and because earthworms which are known to be able to concentrate DDT in their tissues make up a significant portion of the woodcock's diet, fear has been expressed that the species was in serious danger. It was reported by DeWitt, Stickel, and Springer (Circ. 167, U. S. Dept. of Interior, Fish and Wildlife Service, p. 93, 1963) that residues of DDT averaging 1.7 p.p.m. and heptachlor epoxide averaging 1.6 p.p.m. commonly occurred in samples of "field specimens found dead or collected and analyzed at Patuxent". Obviously, however, populations of this bird have not been adversely affected. Comparison of U. S. Department of the Interior Fish and Wildlife Service Regulation 63, issued September 1961, p. 21 and Regulatory Announcement 70, issued August, 1963, p. 9, shows that the hunting season in Louisiana for 1963-64 was increased from 40 days to 50 days, the daily bag limit from 4 to 5 birds, and the possession limit from 8 to 10 birds.

Louisiana fish catch data from "Fisheries Statistics of the United States" U. S. Department of Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries during the period 1954-1963 for the Mississippi River, Atchafalaya River, Red River and its tributaries, Boeuf River, Oachita River and its tributaries, and Inland Lakes and Streams show that the greatest yield of catfish and buffalo fish during this period was harvested during 1962 and the second highest yield during 1963.

In the April 10, 1964 issue of Outdoor News

Bulletin, Vol. 18, no. 7, p. 2 - published by the Wildlife Management Institute a discussion entitled "Pesticides Debate Moves Toward Center Ring" contains the following statement, "Despite scattered allegations in the press, the Department of the Interior is unable to verify any unusual mortality of migratory birds in the problem area".

The availability of an abundance of the sort of evidence cited above makes it difficult to conclude that any cause for alarm exists as to the possibility of permanent harm to wildlife populations resulting from normal agricultural usage of insecticides. If aldrin, dieldrin and endrin have not caused demonstrable harm to wildlife and fish populations during the more than 10 years in which they have been used so extensively, it does not seem reasonable to expect that it may ever occur, especially since it is known that use of these materials is declining steadily in many areas.

We at Louisiana State University have been vitally concerned about undesirable side effects which result from some uses of these potent insecticides. Our recommendations have stressed the necessity for applying insecticides for control of pests only when an assessment of the pest population in question shows the presence of a potentially damaging level of infestation. We have recognized that many of these insecticides are highly toxic and have attempted to obtain information bearing on possible hazards related to recommended uses. For example, when endrin was first recommended for controlling the sugarcane borer we were interested in determining if sheep grazed in sugarcane fields for weed control would be harmed, and also if the flesh of animals permitted to graze in these fields would be contaminated. An appropriate experiment was conducted to obtain information on these points. Results were published in the Journal of Economic Entomology, Vol. 54, p. 605, 1961. Mr. Examiner, I ask permission to place reprints of this article in evidence.

Results showed that sheep allowed to graze on endrin treated pasture for a period of 9 weeks gained weight at the same rate as comparable animals on untreated pasture and showed no evidence of any adverse effects in spite of the fact that they stored as much as 23.7 p.p.m. of endrin in their fat.

We have also been concerned about the effect of various insecticides on crawfish, especially since a considerable percentage of the crop is produced in rice fields which may be treated with several insecticides for control of various pests. Results of studies to obtain information on this point were reported in Transactions of the American

Fisheries Society, Vol. 92, pp. 428-431, 1963.

Mr. Examiner, I ask permission to place reprints of this article in evidence.

When it was decided recently to recommend treatment of rice seed with Aldrin for control of rice water weevil and grape colaspis, we were concerned with the possible effects of this insecticide on crawfish since production of these animals in rotation with rice is becoming an increasingly important practice in Louisiana. Experiments designed to give information on this point have been conducted. Detailed results are presented in Appendix 1 of this report. Results of these studies show that the yield per acre, number of animals produced per acre, and average weight per individual do not differ significantly in plots seeded with Aldrin treated seed at the rate of 0.25 pound per 100 pounds of seed and plots seeded with untreated seed. Analyses of crawfish produced on these plots by Miss Frances Bonner and her associates of the Feed and Fertilizer Laboratory, Louisiana State University showed that there were no differences in the amounts of Aldrin or Dieldrin in the animals produced on plots seeded to rice treated at the rate of 0.25 pound Aldrin per 100 and those produced on plots seeded to untreated rice.

Data presented by Public Health Service at the first of these hearings upon the effects of intraperitoneal injections into mice of extracts from channel catfish reported to contain from 1/2 to 6 micrograms per gram of tissue, wet weight, showed death to be produced in 5 minutes at a dose of 0.5 ml. of the oil extract. We have attempted to duplicate this test using Endrin instead of extracts from affected fish. Appropriate experiments to determine the LD50 of Endrin to a strain of Swiss white mice by intraperitoneal injection were conducted by Dr. Jerry B. Graves and his assistants in the Department of Entomology. Detailed results are presented in Appendix 2 of this report. Results obtained were at considerable variance with those reported by Public Health Service, and lead us to conclude that some toxic factor other than, or in addition to, Endrin was present in the extracts from fish.

These, plus other data and observations presented during these hearings, show the obvious need for a great deal more study before it can be safely concluded that Aldrin, Dieldrin, and Endrin are responsible for, or even involved in, the so-called "massive and continuing fish-kills" in the lower Mississippi Basin drainage areas.

Those who have the responsibility for deciding whether any modification of the current registered agricultural uses of Aldrin, Dieldrin, and Endrin is necessary should give serious consideration to the following points:

1. The fish kills involved were described by Mr. Robert A. Lafleur, Executive Secretary, Louisiana Stream Control Commission in his "Statement Before The Senate Sub-Committee on Organization, Senator Abraham Ribicoff, Acting Chairman, Washington, D. C., April 16, 1964," as being completely different from the kills which have been attributed to Endrin in streams of the Louisiana sugarcane producing area. He describes the latter as an "acute shock kill" and the kills on the Mississippi and Atchafalaya Rivers as a "chronic species discriminating kill" observed only in these streams. If Endrin is responsible for the kills reported in the Atchafalaya and Mississippi Rivers it would be difficult to explain why similar kills do not occur in the sugarcane areas where it is known that so-called "acute" kills have sometimes occurred as a result of contaminating waters with Endrin applied for control of the sugarcane borer. The only logical alternative to such a conclusion is that Endrin disappears from water almost immediately after being introduced into it. Such a conclusion is not consistent with data presented at these hearings, nor with the idea that the fish mortality with which we are concerned is the result of exposure to chronic dosages of Endrin.

2. If Aldrin, Dieldrin, and Endrin are responsible for these kills in Louisiana, why have they not occurred in

the Red and Black Rivers and other streams of the Atchafalaya Drainage Basin above the Old River connection with the Mississippi River? These streams drain vast areas which have been intensively treated with these insecticides for more than 10 years.

3. If Aldrin, Dieldrin and Endrin are responsible for these kills why did they not occur prior to 1960? Data presented during these hearings show that use of these materials has declined drastically during the last several years in much of the area which drains into the Mississippi River.

4. Why have the kills not been continuous if they are the result of accumulating lethal doses of these insecticides from continuous exposure to minute amounts?

5. Since the toxicity of Aldrin, Dieldrin, and Endrin is greater at high than at low temperatures, why have these kills occurred only during late fall and winter months when water temperatures are considerably lower than during the summer months?

6. No data have been presented to show that any hazard to human health exists as a result of normal agricultural usage of these insecticides. In this connection several points are pertinent in the testimony of Mr. George P. Larrick, Commissioner of Food and Drug Administration as

given in Volume 16 of the United States Senate, Report of Proceedings, Hearing held before Subcommittee on Reorganization and International Organizations of the Committee on Government Operations, Environment Hazards, Control of Pesticides and Other Chemical Poisons, April 8, 1964. I should like to quote the following from that document.

Pages 1234-1235.

"Senator Ribicoff. Well, what if milk had the same amount of Endrin as there is in the New Orleans water supply? Could you detect it?

Mr. Larrick. Not by that method. The method that was used by the Public Health Service, as I understand it, could detect these parts per billion of Endrin in the city water supply -- involved taking 5,000 gallons of water, running it through charcoal, where the Endrin is concentrated in the charcoal, and then taking the charcoal and analyzing it.

Now, we could not, as a practical matter, in analyzing milk, take 5,000 gallons of milk and run it through charcoal. It just wouldn't be practicable to do it.

Senator Ribicoff. Well, let's leave milk.

Suppose you had jurisdiction over water, and you found that much Endrin in water. What would be your attitude?

"Mr. Larrick. I would think actually that that would be pharmacologically insignificant."

Page 1237.

"Mr. Larrick. Let me say this: When the original pesticide law was passed, and the zero tolerance was included, the methods of analysis that we had were far less able than they are today. Later, when Congress considered the same questions with respect to food additives, and with respect to color additives, the Department and we did recommend that the type of zero tolerance which is included in the pesticide law, is unrealistic, and unworkable. And we recommended, and the Congress acted upon the recommendation, that the statute provide that the tolerance be zero when determined by a method of analysis chosen by the Food and Drug Administration.

I do think that the zero tolerance in this pesticide law, as it stands, does not make good sense.

Senator Ribicoff. Well, what does make sense? What do you think makes sense?

Don't you think -- what do you think makes sense?

Mr. Larrick. First, in all instances where it can be done, I think the whole question should go through the tolerance-making procedure and a finite "tolerance should be set.

Senator Ribicoff. On milk, too?

Mr. Larrick. Yes, on milk, too."

The position of the College of Agriculture, Louisiana State University on this matter may be summarized as follows:

1. Aldrin, Dieldrin, and Endrin have more than a 10-year history of successful use in Louisiana agriculture for the control of a large number of important insect pests without any conclusive evidence of hazard to human health or more than transitory effect on extremely localized populations of wildlife species.

2. There are important uses of these materials for which no effective substitutes are available. In the case of a number of uses for which substitutes are available, such materials are so much more expensive than Aldrin, Dieldrin and Endrin that production costs of the crops in question would be increased considerably.

3. Withdrawal or imposition of severe limitations upon the use of these insecticides would result in use of chemicals known to be potentially more dangerous to man and his domestic animals. In addition, analytical techniques for some of the latter chemicals are so crude comparatively that their presence in the environment could not be monitored effectively.

Therefore, Mr. Examiner, we urge that the officials charged with the responsibility of reviewing this matter take no action which would result in withdrawal from the market or the imposition of severe restrictions upon normal agricultural use of Aldrin, Dieldrin, and Endrin until data are made available which prove without reasonable doubt that their continued use poses a hazard to human health or permanent damage to wildlife populations.

* * *

L. D. Newsom

Crawfish production in rice paddies treated with aldrin, carbaryl and method parathion.

by

Rodney D. Hendrick and L. D. Newsom
in cooperation with
USDA, ARS, Rice Insects Investigations, Baton Rouge, Louisiana
The Rice Experiment Station, Crowley, Louisiana
and L.S.U. Cooperative Wildlife Unit, Baton Rouge, Louisiana

Crawfish production in rice fields is common practice in Southwest Louisiana. No information was available on the effect of insect control measures on crawfish production. In the spring of 1963 a field experiment was initiated to investigate crawfish production in paddies treated with insecticides. Experimental plots were located at the Rice Experiment Station, Crowley, Louisiana.

The experiment consisted of 4 replications of 6 treatments. The treatments were as follows:

1. Aldrin applied as a seed treatment at .25 lb/100 pounds seed.

2. Methyl parathion applied as a spray at the time of heading at the rate of .25 lb per acre.

3. Carbaryl applied as a spray at the time of heading at the rate of .7 lbs./acre.

4. Aldrin applied as a sub-treatment at .25 lb./100 lb. seed and method parathion as a spray at the time of heading at the rate of .25 lb/acre.

5. Aldrin applied as a seed treatment at .25/100 lb. seed and carbaryl as a spray at the time of heading at the rate of .7 lb/acre.

6. Untreated check.

Each plot was 40 x 40 feet surrounded by an earth levee. An 18 inch high fence of 12 mil polyethylene plastic was placed on top of the levee to prevent migration of crawfish.

In October the polyethylene fence was replaced with one of 14 mesh aluminum screen.

Rice was drill planted on May 25 and 26 at the rate of 100 lbs/acre. An aerial application of 20-20-8 fertilizer was applied in mid-May. The plots were stocked with 50 pairs of crawfish per plot. This stocking was necessary as no crawfish are found in the field in the Rice Station. Soil samples taken prior to planting showed residues of .25 to 1.07 p.p.m. of aldrin ano dieldrin. This residue was the result of an application of 5 lbs. of dieldrin per acre in 1958 for control of white fringed beetle. Prior to this treatment, crawfish were found on the Experiment Station property.

Periodic checks were made on the crawfish populations through the summer, fall and winter. In February crawfish of marketable size were present in the plots. A systematic harvest of crawfish was begun on February 11 and continued at biweekly intervals. Sampling dates were February 11, 23, March 8, 25 and April 9. Carapace length and weight was taken on 40 individuals per plot. The number of crawfish harvested was recorded along with the harvested weight. A sample of crawfish was removed from the collections of February, March and April and frozen for residue analysis. Plots are to be drained and final collections made on April 24 and 25, 1964.

Results: No mortality was observed in the brood crawfish placed in the plots. There was no difference in mortality between crawfish caged on the drill row in plots planted with aldrin treated seed and those planted with untreated seed. Growth was good in all plots. The brood crawfish increased 4-7 times in weight by mid-August. No crawfish with eggs or young crawfish were seen prior to harvest of the rice in mid-September. In October, when the plots were reflooded, young crawfish were collected. Their size indicated that spawning had occurred prior to the harvest of rice.

All crawfish trapped prior to February 11 were weighed and measured and returned to the plot. Beginning with the February 11 collection residue samples and harvestable sized crawfish (14.5 gm. or larger) were removed. The numbers and weights of the crawfish harvested on the 5 sampling dates have been averaged. These data are presented in Table 1. The data on yield in numbers and in pounds have been subjected to analysis of variance. The F value in both yield numbers and weights indicated a singificant difference in yields of the treatments. Significant difference among treatment means were separated by use of orthognal comparisons. The AOV and these comparisons are presented in Table 2. The comparison of aldrin treated plots vs. non-aldrin treated plots showed no significant differences. The comparison of methyl parathion and carbaryl vs. the check was significant in weight but not in numbers. Aldrin alone was significantly different from aldrin and methyl parathion and carbaryl and aldrin in both weight and numbers harvested.

Conclusions: Aldrin applied as a seed treatment at the rate of .25 lb./100 lbs. seed per acre does not decrease the yield of crawfish from rice fields. Methyl parathion and carbaryl applied as sprays at time of heading at .25 and .8 lbs/acre respectively do not decrease the production of crawfish in rice fields. The combination of aldrin seed treatment and methyl parathion as a spray are the insect control measures most compatible with crawfish production. Carbaryl applied as a spray to fields planted with aldrin-treated seed may cause some decrease in crawfish yields.

(Tables 1, 2a, 2b and 3 are as follows:)

Table 2a. Table of values for analysis of variance on number of crawfish harvested.

Source	Sums of Squares	Degree of Freedom	Mean Square	F
Replication	164,640.50	3	54,880.17	
Treatment	90,373.83	5	18,074.77	19.3038**
1,4,5 vs 2,3,6		1		0.0528
2,3 vs 6		1		2.5260
2 vs 3		1		0.4644
1 vs 4,5		1		216.1574**
4 vs 5		1		0.7253
Error	42,613.50	15	2,840.90	
Total	297,627.83	23		

Significance level - 5%
Critical region - 4.5431

Treatment Means

1 Aldrin	2 Methyl parathion	3 Carbaryl	4 Methyl parathion + aldrin	5 Carbaryl + aldrin	6 Check
218	173	158	151	83	131

Table 2b. Table of analysis of variance values for harvested weights of crawfish.

Source	Sums of Squares	Degree of Freedom	Mean Square	F
Replication	483.1135	3	161.0378	
Treatment	228.8971	5	45.7794	6.8760 *
1,4,5 vs 2,3,6		1		.2209
2,3 vs 6		1		9.0449 *
2 vs 3		1		.0138
1 vs 4,5		1		22.9907 **
4 vs 5		1		4.5793 *
Error	98.6887	15	6.6579	
Total	810.6993	23		

Significance level - 5%
Critical region - 4.5431

Treatment Means

1	2	3	4	5	6
Aldrin	Methyl parathion	Carbaryl	Methyl parathion + aldrin	Carbaryl + aldrin	Check
21.4	9.7	8.8	7.7	5.1	6.6

Table 3. Analyses of Aldrin and dieldrin in crawfish produced on treated and untreated plots, Rice Experiment Station, Crowley, Louisiana, 1964. (Analysis by Miss Frances Bonner and associates, Feed and Fertilizer Laboratory, Louisiana State University)

	Aldrin (p.p.b.)	Dieldrin (p.p.m.)
Treatment 1 (Aldrin on seed @ 0.25 lb./100)		
Replicate I	2.1	1.2
Replicate II	2.1	0.4
Replicate III	1.6	0.5
Replicate IV	3.9	0.6
Average	2.4	0.7
Treatment 6 (Check, no treatment)		
Replicate I	22.9	2.7
Replicate II	*	0.6
Replicate III	*	0.4
Replicate IV	*	0.4
Average	–	1.0

* Not detected at 0.4 parts per billion HHDN.

APPENDIX II

Response of Swiss Albino Mice to Intraperitoneal Injection of Endrin

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The toxicological response of mice to intraperitoneal injections of endrin was studied. Two per cent Tween 80 (polyoxyethylene sorbitan monooleate) in corn oil was used as the solvent. Dosage levels of endrin injected were 1, 5, 7.5, 10, 20 and 25.8 p.p.m. Control mice were injected with 0.5 milliliter of two percent Tween 80 in corn oil. The volume of the injected dosages of endrin were all less than 0.25 milliliter except for the highest dosage (25.8 p.p.m.) which was 0.5 milliliter.

The mice were weighed to the nearest 0.1 gram immediately before injection. The amount of enrin required to give the desired dosage was then calculated. A one milliliter syringe equipped with a 27 gauge hypodermic needle was used to inject the correct dosage into the intraperitoneal cavity.

All mice were maintained on a commercially available complete diet and given water *ad libitum*. The temperature of the holding room was 80°F. ± 5°.

Observations were made at 1, 4, 8, 12 and 24 hours after treatment.

Experimental animals: Swiss Albino mice of the ICR strain were utilized in this study. These mice were approximately 30 days old and weighed from 16 to 23 grams each.

Preparation of Endrin solutions: A 0.1% (W/V) solution of endrin in corn oil was prepared in the following manner. One hundred three and one tenth milligrams of technical endrin (97%) was dissolved in 5 milliliters of acetone. Two grams of Tween 80 was added as an emulsifier. This solution was aspirated gently for one hour to remove the acetone. Corn oil was then added to a volume of 100 milliliters. A 0.01% (W/V) solution of endrin was prepared by adding 10 milliliters of the 0.1% solution to 90 milliliters of corn oil. Two grams of Tween 80 made up to a 100 milliliter volume with corn oil was used as the control solution.

Results: The actual mortality of the mice to the various dosages of injected endrin at 1, 4, 8, 12 and 24 hours after injection is shown in Table 1. Table 2 presents the per cent mortality at these time intervals.

No mortality was obtained in the control or at the 1 p.p.m. level of endrin during the 24 hour observation period. At the 5 p.p.m. level of endrin, 25% mortality was obtained in both male and female mice 24 hours after injection. However, at the 12 hour post-treatment observation, no mortality was noted. Female mice injected at the 7.5 p.p.m. level were all alive 12 hours after treatment. However, at the 24 hour observation period, 75% mortality was recorded.

At the 10 p.p.m. dosage, no mortality was noted until the 8 hour post-treatment observation. Forty per cent of the males and 33 per cent of the females were dead at this time. One hundred per cent mortality was recorded at the 12 hour post-treatment observation of the males. However, no further mortality was noted for the females.

Male mice injected with a 20 p.p.m. dosage of endrin showed no mortality 1 hour after treatment. Fifty per cent mortality was recorded at 8 hours, 75 per cent mortality at 12 hours; however, no further increase in mortality was observed.

A single male injected at a dosage level of 25.8 p.p.m. was alive at the 1 hour post-treatment observation. No observation was made at the 4 hour interval. At the

8 hour observation period, the male was dead.

Conclusions:

1. Based on these data, the 24-hour LD-50 for mice injected intraperitoneally with endrin in corn oil is 5-10 p.p.m. (5-10 mg/kg.)

2. Intraperitoneal injection of mice with dosages as high as 25.8 p.p.m. resulted in no immediate mortality.

(Tables 1 and 2 are as follows:)

Table 1. Mortality of Swiss albino mice to intraperitoneal injection of endrin.

Dosage (p.p.m.)	Number Injected		Hours After Injection									
			1		4		8		12		24	
	M	F	M	F	M	F	M	F	M	F	M	F
Control (0)	3	4	0	0	X	0	0	0	0	0	0	0
1	4	4	0	0	X	0	0	0	0	0	0	0
5	4	4	0	0	X	0	0	0	0	0	1	1
7.5	0	4		0		0		0		0		3
10	5	3	0	0	X	0	2	1	5	1		1
20	4	0	0		X		2		3		3	
25.8	1	0	0		X		1					

X - Observations were not made on male mice at 4 hours after injection.

Table 2 Per cent mortality of Swiss albino mice to intraperitoneal injection of endrin.

Dosage	Number Injected		Hours After Injection									
			1		4		8		12		24	
(p.p.m.)	M	F	M	F	M	F	M	F	M	F	M	F
Control (0)	3	4	0	0	X	0	0	0	0	0	0	0
1	4	4	0	0	X	0	0	0	0	0	0	0
[illegible]	[illegible]	[illegible]	0	0	X	0	0	0	0	0	25	25
7.5	6	4		0		0		0		0		75
10	5	3	0	0	X	0	40	33	100	33		33
20	4	0	0		X		50		75		75	
25.0	1	0	0		X		100					

X - Observations were not made on male mice at 4 hours after injection.

L. D. Newsom

ACUTE EFFECTS OF ENDRIN ON CHANNEL CATFISH
Ictalurus punctatus (Rafinesque)

METHODS:

Channel catfish, Ictalurus punctatus (Rafinesque), were purchased from one-year old hatchery stock spawned in May, 1963. The experimental channel catfish were raised on commercial fish foods in a 3-acre pond at Kinder, Louisiana. A ground water supply from 200 feet depth flowed continuously through the pond. There were no pesticides or insecticides used in or around the pond. The experimental channel catfish were transported on April 16, 1964, to the Louisiana Wildlife and Fisheries, Division of Water Pollution Control Laboratory, Baton Rouge, Louisana in an oxygenated tank. No mortality or adverse effects as the result of transfer were noted over a 24-hour period. The test fish had not been fed for 5 days prior to transfer to Baton Rouge and were not fed during bioassay.

Water used for static bioassay was taken from the tank in which the test animals were being held. This water had been allowed to stand in a large concrete pool (4 x 8 x 4 feet). Aeration and gradual replacement with tap water was used to keep the water in the large holding tank suitable for the test fish. Tap water from Baton Rouge artesian wells had a pH of 7.5, alkalinity of 8 p.p.m., and total dissolved solids of 205 p.p.m. One channel catfish was placed in a gallon glass jar containing 1900 milliliters of water. Volumes in test jars were brought to 2 liters with appropriate dilution of stock material or with water in the case of controls. Forced aeration was used to maintain oxygen saturation levels. Tests were conducted at 20°C. ± 2° C.

Test animals varied between 4 and 6 inches in total length and 26 to 30 grams in weight. Each test fish was examined for injuries before being placed in test containers. Only unmarked, active fish were used in all tests.

PREPARATION OF SOLUTIONS:

Technical Endrin (97% pure) was weighed out on an analytical double pan balance to the nearest 0.1 milligram. Two hundred milligrams were dissolved in 100 milliliters of distilled, reagent acetone (2 mg/ml) and serial dilutions made in the following manner:

One ml of solution A (2 mg/ml) was added to a 100 ml volumetric flask and diluted to volume with distilled reagent acetone, solution B (0.020 mg/ml). A third solution was prepared by diluting 1 ml of solution B to 100 ml with the reagent acetone, solution C (0.0002 mg/ml).

Appropriate amounts of these solutions were added to a 100 ml volumetric flask, diluted to 100 ml with the tank water, and added to the test jars; giving final desired concentrations in 2 liters of test solution (Table 1).

RESULTS:

Relatively short-term static bioassay at endrin concentrations less than 10 p.p.b. in 2 liters of water was not found to be lethal to channel catfish in 96 hours. Concentration of 10 p.p.b. endrin was not lethal in 36 hours (Table 2). Initial concentrations of 50 p.p.b. and greater were lethal in less than three hours. In the case of 50 p.p.b., a second fish added to the same jar following the death of the first test fish has survived for 12 hours. This may be indicative of reduction in total endrin content by extraction-absorption by the initial fish.

At initial concentrations above 50 p.p.b. test fish underwent violent reactions, such as rapid swimming and striking walls of the jar, followed by rigid body condition between head and upper caudal peduncle. All fins except the caudal fin became extended and rigid. Opercular movement became rapid. Test fish would regain swimming control and repeat this sequence several times. Six of 11 test fish were observed to have distended abdomens and to be partially floating (Table 3). Distention of the abdomen was easily observed as the result of the lack of food prior to testing. Prior to death, the abdomen became flat again and animals sank to the bottom of the jars.

Prior to and following death of test fish, areas of blood clotting beneath the skin were evident on 7 of the 11 fish. The area between the pectoral fins was affected most commonly (Table 3).

(Tables 1, 2 and 3 are as follows:)

Table 1. Total concentrations of test solutions in parts per billion (ppb), microgram contents in 2 liters, and micrograms endrin per gram wet weight (approx. 28 gms.) of fish.

Test solution (p.p.b.)	µgram content	µgrams/gram Endrin/fish
0.1	0.2	0.007
1.0	2.0	0.071
5.0	10.0	0.360
10.0	20.0	0.714
50.0	100.0	3.600
100.0	200.0	7.143
1000.0	2000.0	71.430

Table 2. Static bioassay results of channel catfish in various concentrations of endrin.

Concentration (p.p.b.)	Number test fish	Duration of test hours	Mortality (No. dead)
Control	5	96	1[a]
0.1	5	96	0
1.0	5	96	0
5.0	4	48	0
10.0	4	36	0
50.0	1	< 3	1
100.0	5	1	5
1000.0	5	1.5	2
		< 3	3

[a] Aeration stone out of solution (Dissolved Oxygen of water 2.5 p.p.m.)

Table 3. Reactions and External Symptoms of Channel Catfish During Testing

Concentrations of Endrin (ppb)		Reactions During Test Period						External Symptoms after Death			
									Visible Internal Blood C		
	Test Fish	Violent Reaction	Swimming at Surface	Rapid Operculum Movement	Rigid on Bottom	Rigid Floating	Abdomen Distended	Mouth & Operculum Distended	Base Pectorals	Anal Fin	Caud
1000	# 1	X	-	X	X	-	-	-	X	-	
	# 2	X	-	X	X	-	X	-	X	X	
	# 3	X	-	-	-	-	-	X	-	X	
	# 4	X	-	-	X	-	-	X	-	-	
	# 5	-	-	-	-	X	X	X	X	-	
100	# 1	X	X	-	X	-	-	X	-	-	
	# 2	X	X	-	X	-	X	X	X	-	
	# 3	X	-	-	-	-	X	X	X	-	
	# 4	X	-	X	-	-	X	X	-	-	
	# 5	X	-	X	-	-	X	X	X	-	
50	# 1	-	-	-	-	-	-	X	-	-	
	# 2	Added Following Removal of Fish # 1. (No reaction in 12 hours)									
10	# 1	No Reactions									
	# 2	No Reactions									
	# 3	-	X	-	-	-	-				
	# 4	No Reactions									
5	# 1	-	X	-	-	-	-				
	# 2	-	X	-	-	-	-				
	# 3	-	X	-	-	-	-				
	# 4	No Reactions									
1	# 1	X	-	X	X	-	X				
	# 2-5	No Reactions									
0.1	# 1-5	No Reactions									

* * *

L. D. Newsom

April 9, 1964

Mr. Chairman:

My name is L. D. Newsom. I am head of the Department of Entomology, Louisiana State University, and represent that institution at this hearing. I should like to thank you for the privilege of being heard on this subject of grave importance to our society.

The necessity for controlling insect pests of importance to agriculture and public health is, I believe, accepted by all responsible segments of our society. Insects are the most effective of man's competitors for food and fiber and are recognized as being of prime importance as vectors of many important diseases of man and other animals. Thus, it seems to be an obvious fact that these pests must be controlled even more efficiently in the future than at present if our exploding population is to be fed and clothed adequately and protected from insect-borne diseases.

It is also recognized that use of insecticides is the only satisfactory means currently available for controlling the great majority of insects and related pests. Entomologists have recognized that the widespread use of some of these materials has had a number of undesirable side effects. A great deal of research has been directed toward alleviating problems created by use of insecticides. Progress is being made in developing techniques of insect control which do not have some of the disadvantages of insecticide use.

We at Louisiana State University take the unequivocal position that if the use of any insecticide, or group of insecticides, creates a hazard to human health, its use must be discontinued. However, it is also our position that before any recommendation is made which would result in the complete withdrawal from use, or which would impose severe restrictions upon the use of an insecticide, it should be established without reasonable doubt that such hazards are involved. In the case of the purported contamination of streams of the Mississippi River Drainage Basin by aldrin, dieldrin, and endrin we are not aware of any data having been made public at this time if ineed it exists at all, which establishes that a hazard to human health is involved in continued use of these materials.

We do not accept information in the form of press releases as scientific proof of fish and wildlife kill and contamination of drinking water to the extent that a hazard to human health is involved. Techniques of analysis for insecticide residues have become so sensitive that the presence of many of these materials can be demonstrated in such small amounts that production of biological effects are doubtful. Certainly, biological effects have not been demonstrated at levels of a few parts per trillion.

Fish kills have occurred in waters of the Mississippi River Drainage Basin. Estimated numbers killed in the Atchafalaya and Mississippi Rivers during 1960-63 are given in Table 1.

Table 1. Estimated numbers of fish killed in the Mississippi and Atchafalaya Rivers in Louisiana, 1960-63. Data supplied by Louisiana Stream Control Commission.

	Mississippi		Atchafalaya
Year	Fresh Water	Salt Water	Fresh Water
	Thousands		
1960	100[a]	1,000	2,500[b]
1961	25	200	50
1962	25	200	50
1963	75	5,000	100

[a] Kill from Lake Providence, Louisiana to Gulf of Mexico observed by L.S.C.C. personnel, predominantly catfish. Largest kills in freshwater impoundments at Port Sulphur, Louisiana. Reports of kills to Memphis and St. Louis.

[b]Kills observed from Old River to Morgan City, Louisiana, greatest on east side of basin. No chronic kill outside of basin or in the Red River.

If these fish kills are a result of normal agricultural usage of aldrin, dieldrin, and endrin, or other insecticides, it would seem logical that similar or greater kills should have also occurred in the tributaries to these streams since it would be through them that the insecticides would have to move to the larger streams. If such kills have occurred in these tributaries, they have not been reported.

Fish catch data from streams in Arkansas, Louisiana and Mississippi and shellfish catch data for Louisiana given in table 2 for the period 1954-61 do not indicate that insecticide usage in these States has affected populations of buffalofish, catfish or shellfish. Estimates of the amounts of the most commonly used insecticides sold in Arkansas and Louisiana are given in table 3. If their use is responsible for the fish kills being reported, it is difficult to understand why they did not begin to show up prior to 1960.

Withdrawal, or severe restrictions upon use of these insecticides would have the following immediate and highly significant effects upon Louisiana agriculuure:

1. It would approximately triple the cost of sugarcane borer control and result in substitution of guthion at the rate of 1.5 pounds per acre for Endrin at 0.3 pound per acre. Since the 96 hr.$_{\text{TLm}}$ of guthion to bluegills is reported to be 0.0052 ppm and Endrin 0.0006 (Tarzwell, 1959), little alleviation of the hazard to fish could be expected.

2. Toxaphene or strobane at 2 pounds plus DDT at 1 pound per acre or methyl parathion at 1 pound per acre would be substituted for much of the Endrin being used at 0.2 pound per acre for bollworm control. This would not alleviate hazard to fish since the 96 hr.$_{\text{TLm}}$ of toxaphene to bluegill is 0.0035 ppm and DDT 0.016 ppm and much greater quantities would be required. A further disadvantage which would result from this lies in the fact that techniques for the analysis of toxaphene and strobane are not specific. Therefore, the amounts of these materials, which are also highly toxic to fish, which might get into streams could not be monitored effectively. However, a far more serious disadvantage would be the acute toxicity hazard to humans which would result from the use of such high rates of methyl parathion as would be required for bollworm control.

Therefore, Mr. Chairman, I should like to urge that no action be taken which would result in withdrawal from the market, or impose severe restrictions upon use of these insecticides until data are made available which prove without reasonable doubt that their continued use poses a hazard to human health or permanent damage to wildlife populations.)

Table 2. Fish catch data for the period 1954-1960. Data from "Fishery Statistics Of The United States" - United States Department of The Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries.

	ARKANSAS						
	Miss. River & Tributaries	Ark. River & Tributaries	Boeuf River	Red River & Tributaries	White River & Tributaries	Inland Lakes & Streams	Total
				1,000 Pounds			
1954							
Buffalofish	829	501	14	428	1,480	68	3,320
Catfish	351	193	12	192	374	32	1,154
1955							
Buffalofish	707	400	12	364	1,237	103	2,823
Catfish	286	145	-	142	284	26	883
1956							
Buffalofish	736	440	14	366	1,122	49	2,727
Catfish	295	161	-	148	257	11	871
1957							
Buffalofish	295	238	16	34	576	243	1,402
Catfish	128	35	3	32	232	46	475
1958							
Buffalofish	1,419	734	12	170	784	245	3,364
Catfish	298	282	8	48	218	80	934
1959							
Buffalofish	1,206	731	19	105	853	183	3,097
Catfish	303	214	9	42	215	62	844
1960							
Buffalofish	1,038	770	17	77	612	301	2,814
Catfish	370	283	10	36	178	29	905

Table 2.

Fish catch data for the period 1954-1963. Data from "Fishery Statistics Of The United States" - United States Department of Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries.

			LOUISIANA				
	Miss. River & Tributaries	Atchafalaya River	Boeuf River	Ouachita & Tributaries	Red River & Tributaries	Inland Lakes & Streams	Total
			1,000 Pounds				
1954 Buffalofish	347	567	242	1,255	865	228	3,504
Catfish	208	1,192	32	312	284	209	2,237
1955 Buffalofish	179	796	180	836	895	-	2,886
Catfish	183	1,099	24	257	284	-	1,846
1956 Buffalofish	453	418	909	237	480	104	2,600
Catfish	985	939	198	34	181	45	2,381
1957 Buffalofish	261	870	182	293	894	-	2,500
Catfish	179	1,192	24	77	312	-	1,784
1958 Buffalofish	284	950	137	416	1,276	74	3,136
Catfish	217	2,289	39	137	656	49	3,387
1959 Buffalofish	271	1,046	77	419	1,292	239	3,344
Catfish	226	2,049	58	162	533	180	3,209
1960 Buffalofish	196	768	150	576	283	787	2,759
Catfish	194	1,545	75	212	143	502	2,670
1961 Buffalofish	240	578	84	448	223	629	2,201
Catfish	258	1,499	50	183	126	498	2,613
1962 Buffalofish							2,701
Catfish							8,255
1963 Buffalofish							2,393
Catfish							6,683

Table 2

Fish catch data for the period 1954-1960. Data from "Fishery Statistics of the United States" - United States Department of The Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries.

MISSISSIPPI

		Mississippi River	Inland Lakes	Total
			1,000 Pounds	
1954	Buffalofish	135	312	447
	Catfish	86	198	284
1955	Buffalofish	226	1,500	1,726
	Catfish	109	610	719
1956	Buffalofish	416	837	1,253
	Catfish	72	458	530
1957	Buffalofish	740	473	1,213
	Catfish	504	125	629
1958	Buffalofish	528	289	817
	Catfish	309	101	410
1959	Buffalofish	424	404	828
	Catfish	280	93	373
1960	Buffalofish	431	806	1,237
	Catfish	307	273	580

Table 2

Shellfish catch data for Louisiana 1954-1963. Data from "Fishery Statistics of the United States" by E. A. Power, United States Department of the Interior, Fish and Wildlife Service.

Year	Shrimp	Crawfish	Shellfish
		1,000 Pounds	
1954	84	0.5	100
1955	72	0.4	93
1956	61	0.3	81
1957	34	0.4	54
1958	41	0.7	60
1959	57	0.3	78
1960	62	0.7	81
1961	31	1.0	55
1962[a]	43	1.3	60
1963[a]	[b]	-	97

[a] Preliminary data from Louisiana Landings, U. S. Department of the Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries in cooperation with Louisiana Wildlife and Fisheries Commission, Division of Oyster and Water Bottoms and Commercial Seafood.

[b] Over 90 million pounds heads-on weight according to press release by L. D. Young, Jr., Louisiana Wildlife and Fisheries Commission Director.

Table 3. **Amounts of insecticides used in Arkansas 1952-1963. Data supplied by C. G. Lincoln.**

Year	1,000 Pounds					
	DDT	BHC	Toxaphene	Aldrin	Dieldrin	Endrin
1952	1,800	476	2,779	102	11	0
1953	849	281	2,362	43	8	0
1954	1,439	487	2,490	79	9	0
1955	3,494	1,225	4,711	203	45	198
1956	4,161	987	4,633	427	45	279
1957	4,899	879	3,430	- [a]	- [a]	420
1958	5,617	573	2,895	-	-	407
1959	9,404	419	4,574	14[b]	-	480
1960	7,363	255	2,302	92	-	223
1961	2,212	60	1,151	111	-	146
1962	1,435	33	789	114	-	133
1963	905	15	519	1,139	-	87

[a] Figures for aldrin and dieldrin combined with those for endrin.

[b] Amounts of aldrin reported from 1959-1963 were for rice seed treatment.

Table 3[a]. Amounts of insecticides used in Louisiana 1950-1962. Data supplied by L.S.U. Agricultural Extension Service.

Year	DDT	Dieldrin	Aldrin	BHC	Toxaphene	Endrin
			1,000 Pounds			
1950	961	0.09	42	425	530	0
1951	1,678	6	147	744	1,815	0
1952	1,100	5	52	534	784	0
1953	2,088	51	33	928	2,060	6
1954	1,869	17	6	706	1,019	28
1955	1,734	27	4	670	1,196	48
1956	976	28	21	295	649	50
1957	1,119	11	6	191	650	38
1958	1,141	66	2	59	1,131	87
1959	5,160	40	3	278	1,330	114
1960	861	11	13	6	1,067	98
1961	1,821	14	7	19	877	178
1962	1,827	8	2	15	1,624	62

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[a] Insecticides for use on cotton and sugarcane only reported for 1953 and 1954. Increase in amount of endrin beginning in 1958 resulted from its use for control of sugarcane borer. Area treated with endrin does not drain into the Mississippi River.

MR. NEWSOM: There are a few more statements I should like to make here, Mr. Chairman.

Since there has been quite a bit of discussion of chromatographic analyses, I should like to read an abstract of an article reprinted from Analytical Chemistry, Volume 35, Pages 474 to 481, April 1963, by Dr. J. E. Lovelock, Baylor University College of Medicine, Houston, Texas.

The electron absorption detector is by far the most sensitive detection device available for use in gas chromatography; furthermore, its selectivity permits the realization of extreme sensitivities in the face of a high level of extraneous material. These desirable properties have encouraged its widespread use in such otherwise intractable problems as pesticide trace analysis. It is not commonly realized, however, that the simpler and frequently used versions of this device are readily capable of generating erroneous and even totally false responses. This paper describes the basis of operation of electron absorption detectors and the nature and cause of the erroneous and anomalous responses it may generate. An alternative method of analysis by electron absorption is the pulse sampling technique; this retains the sensitivity and selectivity of the simple low potential ion chamber method, but is substantially free of errors and anomalous responses. The basis of this improved method is described and an account is given of the technique for its use in quantitative and qualitative analysis.

Detection of components emerging in the effluent stream of a gas chromatography column by electron absorption was first reported in 1958 (8). At that time there was a need for a simple sensitive detector which would extend the range of gas chromatographic measurement beyond that possible with the relatively insensitive thermal conductivity and gas density balance detectors. Several methods were tried, based on the fact that the conductivity of gases in an ionization chamber is exquisitely sensitive to small changes in gas composition. When the chamber was filled with nitrogen and ionized by radiation from an internal radioactive source, the conductivity at low applied potentials was observed to change greatly when minute traces of other compounds were present in the vapor phase. Although the method was undoubtedly highly sensitive, the response to vapor concentration was very non-linear and the response factors to different compounds varied greatly and in an unpredictable manner. For quantitative measurement the electron absorption method was soon displaced by more stable ionization processes such as those used in the argon and flame ionization detectors. The possibility of electron absorption in the qualitative analysis of unknown components emerging in a gas chromatography effluent was nevertheless a potential application of this highly selective detection method. A preliminary study of the application of the method for this purpose was reported in 1960 (11). At that time also, conventional methods of gas chromatographic analysis could not be applied where a minute trace of a wanted component was present in great excess of extraneous material moving on the column with a similar retention time. In one particular application, namely, the analysis of pesticide traces in materials of biological origin -- the need was so great that in spite of its many disadvantages the electron absorption method using a simple ion chamber was pressed into use (2). The success of this application was partly attributable to the sensitivity and selectivity of the electron absorption method but mostly due to the painstaking care taken by Goodwin and his colleagues to ensure that some of the anomalous responses of the simple electron absorption detector were avoided. The importance of pesticide trace analysis and the fact that at low levels it is almost impossible to achieve analysis by any other method has led to its widespread use and commercial exploitation. The pace of these developments and the deceptive simplicity of a detector which is no more than a simple ion chamber operated at a low applied potential has given rise to a feeling of confidence in the method which is false and unjustified by the necessary experimental evidence.

The extraordinary sensitivity of the electron absorption detector which enables the analysis of even picagram samples is in itself a hazard to accurate measurement since the fate of such small samples in a chromatographic system is far from certain. In addition the simple, direct current, ion chamber form of electron absorption detector is hardly suitable for quantitative analysis. Small changes in operating conditions can cause its response to vapor concentration to be profoundly nonlinear. Also its capacity to function simultaneously in several different modes of detection renders its use even in qualitative analysis of doubtful reliability. No other detector in use in gas chromatography is so prone to erroneous and even totally false responses.

This communication describes the physical basis of electron absorption measurement; it lists and explains, where possible, the many anomalous responses which so far have been observed with the simple direct current detector. An account is given of the basis and operation of the pulse sampling method of electron absorption analysis (11, 14, 15) by which these false responses can be avoided or reduced. The description of the pulse sampling method is limited, for the detailed theory of its operation is still under investigation and forms the subject of a future communication. The practical performance is however, sufficiently established and its advantages insufficiently recognized to justify its discussion in this paper. The technique of quantitative and qualitative analysis by electron absorption is also discussed.

Now, because of some conflict in testimony at previous hearings we at the Louisiana State University have attempted to repeat some of these to see how our results turn out. One of these involved the injection of Endrin into mice.

In the U. S. Department of Health, Education, and Welfare report for April 6th, on Page 18, I should like to read the following quotation:

> "Viscera of fresh water catfish (kidney, liver, intestine, spleen) were extracted with acetone and dissolved in vegetable oil. Death in mice was produced by intraperitoneal injection of 0.5 ml. and a 0.3 ml. of the oil extract. These quantities represent approximately 1 gram of a visceral tissue. The larger dose produced

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"death in five minutes."

This seems to be a rather rapid effect to us. We attempted to repeat this particular experiment, and an account of it may be found in the first appendix of my April 23rd presentation, and I would like to read from that, if I may -- I am sorry; this is Appendix II. It is entitled "Response of Swiss Albino Mice to Intraperitoneal Injection of Endrin."

In the interests of saving time, I am simply going to read the conclusions, if this meets with your approval.

> "1. Based on these data, the 24 hour LD-50 for mice injected intraperitoneally with endrin in corn oil is 5-10 p.p.m. (5-10 mg/kg.)
>
> "2. Intraperitoneal injection of mice with dosages as high as 25.8 p.p.m. resulted in no immediate mortality."

A second point which we were interested in was some of the symptoms. There seems to be a conflict in symptomatology from the effect of Endrin on channel catfish.

To attempt to resolve these differences, a cooperative study was undertaken by the School of Forestry, Section of Fish and Game Management, Wild Life and Fisheries Commission and the Department of Entomology.

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This was, as I have said, a cooperative study. The work was done largely by Dr. R. G. Mushring of the Fish and Game Department, and Mr. Morton Beck was also cooperating in this.

Since this point still seems to come up and cause difficulty, I should like to read the entire report. The title is "Acute Effects of Endrin on Channel Catfish."

"ACUTE EFFECTS OF ENDRIN ON CHANNEL CATFISH,

Ictalurus punctatus (Rafinesque)

"MEHTODS:

"Channel catfish, Ictalurus punctatus (Rafinesque), were purchased from one-year old hatchery stock spawned in May, 1963. The experimental channel catfish were raised on commercial fish foods in a 3-acre pond at Kinder, Louisiana. A ground water supply from 200 feet depth flowed continuously through the pond. There were no pesticides or insecticides used in or around the pond. The experimental channel catfish were transported on April 16, 1964, to the Louisiana Wildlife and Fisheries, Division of Water Pollution Control Laboratory, Baton Rouge, Louisiana in an oxygenated tank. No mortality or adverse effects as the result of transfer were noted over a 24-hour period. The test fish had not been fed for 5 days prior to transfer "to Baton Rouge and were not fed during bioassay.

"Water used for static bioassay was taken from the tank in which the test animals were being held. This water had been allowed to stand in a large concrete pool (4 x 8 - x 4 feet). Aeration and gradual replacement with tap water was used to keep the water in the large holding tank suitable for the test fish. Tap water from Baton Rouge artesian wells had a pH of 7.6, alkalinity of p.p.m., and total dissolved solids of 205 p.p.m. One channel catfish was placed in a gallon glass jar containing 1900 milliliters of water. Volumes in test jars were brought to 2 liters with appropriate dilution of stock material or with water in the case of controls. Forced aeration was used to maintain oxygen saturation levels. Tests were conducted at 20°C ± 2° C.

" Test animals varied between 4 and 6 inches in total length and 26 to 30 grams in weight. Each test fish was examined for injuries before being placed in test containers. Only unmarked, active fish were used in all tests.

" Technical Endrin (97% pure) was weighed out on an analytical double pan balance to the nearest 0.1 milligram. Two hundred milligrams were dissolved in 100 milliliters of distilled, reagent acetone (2 mg/ml) and serial "dilutions made in the following manner:

"One ml of solution A (2 mg/ml) was added to a 100 ml volumetric flask and diluted to volume with distilled reagent acetone, solution B (0.020 mg/ml). A third solution was prepared by diluting 1 ml of solution B to 100 ml with the reagent acetone, solution C (0.0002 mg/ml).

"Appropriate amounts of these solutions were added to a 100 ml volumetric flask, diluted to 100 ml with the tank water, and added to the test jars; giving final desired concentrations in 2 liters of test solution (Table 1).

"RESULTS:

"Relatively short-term static bioassay at endrin concentrations less than 10 p.p.b. in 2 liters of water was not found to be lethal to channel catfish in 96 hours. Concentration of 10 p.p.b. endrin was not lethal in 36 hours (Table 2). Initial concentrations of 50 p.p.b. and greater were lethal in less than three hours. In the case of 50 p.p.b., a second fish added to the same jar following the death of the first test fish has survived for 12 hours. This may be indicative of reduction in total endrin content by extraction-absorption by the initial fish.

"At initial concentrations above 50 p.p.b. test fish underwent violent reactions, such as rapid swimming and striking walls of the jar, followed by rigid body condition between head and upper caudal peduncle. All fins except the caudal fin became extended and rigid. Opercular movement became rapid. Test fish would regain swimming control and repeat this sequence several times. Six of 11 test fish were observed to have distended abdomens and to be partially floating (Table 3). Distention of the abdomen was easily observed as the result of the lack of food prior to testing. Prior to death, the abdomen became flat again and animals sank to the bottom of the jars.

"Prior to and following death of test fish, areas of blood clotting beneath the skin were evident on 7 of the 11 fish. The area between the pectoral fins was affected most commonly (Table 3)."

You have heard of the symptoms observed in this particular test.

Now, in conclusion, I would like to discuss a matter briefly which I attempted to discuss yesterday afternoon, realizing, Mr. Chairman, that I was out of order at the time, but since you had made such a beautiful speech on the free interchange of scientific information, I thought it was most timely and would be the best time to present it.

Therefore, I want to present this.

In 1961, and even earlier than that, Louisiana State University had been vitally concerned about this whole matter of contamination by our environmental pesticides and their potential effects, not only on wildlife species, but also on the human being, and we requested some cooperation from the Water Pollution Control people in the Public Health Service, Dr. Nicholson, and asked him to come into the sugar cane area of our State, where we considered the Endrin problem to be the most serious one that we had in agricultural practice.

This was done, and an area chosen for study, and a very careful study, in my opinion, was conducted.

As would be expected from such a cooperative venture, we have been supplied with progress reports from time to time, the most recent of which came to me under a letter dated April 10, 1964, which I would like to read now, addressed to Dr. L. D. Newsom. It is headed "Department of Health, Education, and Welfare, Regional Office, Region 14, Room 404, 50 - 7th Street, Northeast, Atlanta, Georgia, 30323." It is dated April 10, 1964.

It is addressed to Dr. L. D. Newsom, Head, Entomological Research, Louisiana Agricultural Experiment Station, Baton Rouge 3, Louisiana.

L. D. Newsom

"Dear Dr. Newsom:

"Dr. Gerald J. Lauer is nearing the completion of his first technical report concerning his studies of endrin usage in sugar cane farming and subsequent runoff in water courses in Louisiana in 1961. In accordance with our prior agreement, I am enclosing a summary of the essential data contained in this report. In this summary a reference is made to a pesticide pollution study progress report dated March 1963. A copy of the progress report was sent to you at the time of its release, but an additional copy is enclosed.

"Sincerely yours,
John R. Thoman
Regional Program Director
Water Supply and Pollution Control

"Enclosures (2) Identical letters to:

"Mr. Robert A. Lafleur, Wild Life and Fisheries Commission, Baton Rouge, Louisiana.

"Mr. Minus Granger, County Agricultural Agent, St. Mary Parish, Franklin, Louisiana.

"Mr. John E. Trygg, Director, Division Public Health Engineer, Louisiana State Board of Health, New Orleans, Louisiana."

This progress report has much that is pertinent to this study. I almost put it into the agricultural hearings without asking permission, but I thought, out of courtesy, it would be well that I do this. I called and was refused permission to put this material into evidence.

I was told that the only way it could be put into evidence would be for the Secretary of Agriculture to contact Secretary Celebrezze for such an arrangement.

Therefore, I had the Dean of our College of Agriculture contact the appropriate officials to see if this could be done. He was denied the permission for this material to be included.

There are people high in the hierarchy of the Public Health Service here, and I should be interested to see if any of them could tell us why this material has not been permitted to go into the conference and into the record.

Mr. Chairman, this concludes my testimony, except for the two additional papers I am submitting for the record.

(The documents referred to are as follows:

ENDRIN RESIDUES IN THE FAT OF LAMBS GRAZED ON ENDRIN-TREATED PASTURE[1]

W. H. Long, L. D. Newsom, and A. M. Mullins,

Louisiana State University, Baton Rouge

Endrin was recommended in 1958 for sugarcane borer (Diatraea saccharalis (F.) control, and has been widely used since then. Four broadcast applications per acre of 12 pounds each of 2% endrin granules are commonly made at 2-week intervals during the growing season.

A few sugarcane growers who were accustomed to grazing sheep in their cane fields for grass control have also desired to use endrin for borer control. To determine what effects the use of endrin might have on these animals and how much endrin might be found in the fat of such animals at different intervals after access to treated areas, 12 young lambs in poor condition were obtained. The test was conducted in grass pastures instead of sugarcane fields because of convenience and also to increase the chances of harming the sheep and contaminating their meat.

Six lambs were placed on each of two grass pastures May 19, 1958. Each pasture was approximately one-half acre in size and was mowed several times during this experiment in an attempt to maintain the height of the grass at approximately 6 inches. Shade was provided by trees at one end of the pastures. A salt box and watering trough were placed in each pasture, but no additional feed was provided.

Two per cent endrin granules were applied broadcast to one of the pastures on the following dates: May 19, June 1, June 10, June 16, June 23, and June 29, 1958. One-fourth pound of actual endrin per acre was applied to the treated pasture at each application. A Cyclone seeder was used to apply the insecticide granules during the early morning while the grass was wet with dew.

The lambs were observed daily for signs of sickness, but no symptoms were noticed. On July 14th after 55 days of continuous grazing on the pastures the two largest lambs in each group were butchered to obtain fat samples for endrin residue analyses. The remaining animals in the treated pasture were transferred to the untreated pasture at this time. Ear tags were used to distinguish those which had grazed on the treated pasture from those which had grazed continuously on the untreated pasture. Half of the remaining lambs were butchered July 28 and the remainder August 25, 1958, or 14 and 42 days, respectively, after removal from the treated pasture.

Each lamb was weighed initially and again at the time of slaughter. The data in table 1 show that all of the lambs gained weight regardless of whether they grazed in the endrin-treated pasture. There was no significant difference in average weight increase between the two groups.

Samples of "internal fat" were taken from around the stomach and from the thoracic cavity of each lamb at the time of slaughter. "External fat" samples were taken from the external surfaces of the carcasses and from fat pockets in the meat after the carcasses had aged for 4 days at 36° to 38° F. All fat samples were frozen and shipped for analyses to the Shell Development Company laboratories at Modesto, California.

Amounts of endrin present in the fat were determined by the chromatographic dechlorination phenyl azide method described by Bann et al. (1958).[2]

Results of analyses given in table 2 show that appreciable endrin residues were still present in lamb fat 42 days after the lambs had been removed from the treated pasture. There was apparently no measurable loss of endrin from fat 14 days after lambs were transferred from the treated to the untreated pasture, although there is an indication of some loss from fat after 42 days away from the treated pasture. Residues were always larger in samples of internal fat than in external fat.

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ENDRIN IN AGRICULTURAL PRODUCTS AND ANIMAL TISSUES. JOUR. AGRIC. FOOD CHEM. 6(3):196-202

FOOTNOTES

1 Accepted for publication December 20, 1960. A cooperative project between the Departments of Entomology and Animal Industry, Louisiana State University and the Shell Chemical Company.

2 The authors wish to thank Dr. Louis Lykken, Shell Chemical Company, and Dr. Paul Porter, Shell Development Company, for chemical analyses of all residue samples. Acknowledgement is also made of field assistance given by Mr. Francis Bliss, Herdsman in the Department of Animal Industry, Louisiana State University

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Table 1. - Weights of lambs before and after grazing on endrin treated and untreated pastures at Baton Rouge, Louisiana, 1958.

Total Number of Days on Pasture	Live Weight (lb.)				Increases in Pounds per Lamb per Day	
	Treated		Untreated			
	Initial	Final	Initial	Final	Treated	Untreated
55	35	53	40	52	0.33	0.22
	45	60	47	63	0.27	0.29
69[a]	51	62	46	58	0.16	0.17
	47	64	46	62	0.25	0.23
97[b]	58	68	72	80	0.10	0.08
	58	63	54	67	0.10	0.13
Means	49	63	51	64	0.20	0.19

[a] Lambs from treated group grazed on treated pasture 55 days followed by 14 days on untreated pasture.

[b] Lambs from treated group grazed on treated pasture 55 days followed by 42 days on untreated pasture.

Table 2. - Endrin residues found in lamb fat from Animals allowed to graze for 55 days on endrin-treated pasture, Baton Rouge, Louisiana 1958.

Days of Feeding on Untreated Pasture	Endrin in Fat (P.P.M.) Internal	Endrin in Fat (P.P.M.) External
0	18.3	11.5
	23.4	14.0
14	23.7	20.1
	20.3	14.6
42	8.9	6.4
	13.8	11.0

L. D. Newsom

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TOXICITY OF TEN INSECTICIDES TO THE RED CRAWFISH

Procambarus clarki (Girard)

Robert J. Muncy and Abe D. Oliver, Jr.

TOXICITY OF TEN INSECTICIDES TO THE RED CRAWFISH

Procambarus clarki (Girard)

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School of Forestry and Wildlife Management

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Louisiana

ABSTRACT

Toxicities to the red crawfish were determined for 10 insecticides considered for use in controlling the forest tent caterpillar or being used to control rice and sugar cane insects. Malathion, dimethoate,

and Mirex were not toxic to crawfish at concentrations effective in large-scale insect control projects. The seven insecticides found to be toxic to crawfish, listed in order of the lowest 24-hour and 72-hour median tolerance limits (TLm), were methyl parathion, endrin, DDT, sevin, Bidrin, Dibrom, and phosphamidon. Methyl parathion was found to remain toxic in water to crustaceans for over 1 month. Bidrin and phosphamidon were effective in controlling the forest tent caterpillar in extensive forested areas at levels approximately 100 times lower than the 24-hour TLm for red crawfish.

INTRODUCTION

A large number of workers have reported upon the toxicity levels of insecticides to various species of fishes (Pickering et al., 1962; Henderson et al., 1959; Hoffmann, 1960; and Rudd and Genelly, 1956). Numerous papers have been presented on the effects of insecticides on aquatic insects (Cope, 1961; Nicholson et al., 1962; and Webb, 1960). However, limited data have been presented on the toxicity of insecticides to crustaceans in marine or fresh water. A review of available literature indicated that no data had been published on the effects of insecticides on freshwater crawfish. Anderson (1960) reported on the toxicity of 12 chlorinated hydrocarbon and organo-phosphorus insecticides to Daphnia magna Straus. Several authors have reported on the effects of insecticides on various marine crustaceans including crabs, barnacles, and shrimp (Loosanoff, 1960, and George et al., 1957).

The freshwater crawfish is represented by 29 species and subspecies in Louisiana (Penn, 1959), where it ranks as an important food item. In this state 717,000 pounds valued at $157,000 were sold in 1960 (Powers, 1962). Crawfish also serve as an important food for commercial and sport fishes. Since aerial spraying of bottomland hardwood forest for the control of the forest tent caterpillar, Malacosoma disstria Hbn., was being considered in some areas where large numbers of crawfish were produced, data on the toxicity to crawfish of several insecticides under consideration for use in controlling this insect were needed.

PROCEDURE

Red crawfish, Procambarus clarki (Girard) were collected for the tests with a minnow seine from a pond located on the Louisiana State University farm at Baton Rouge, Louisiana. Crawfish were sorted by sex and size so that each series of test animals would be as near identical as possible. The crawfish ranged in size from 4 to 10 grams, but those used in each series of tests were nearly uniform in size. During the initial tests several crawfish were placed in each container, but in all later tests only one crawfish was placed in each container. An 8- by 20-inch plastic freezer bas was placed in each gallon jar and tilted on its side at an angle of about 30 degrees. The plastic bags were used to reduce contamination of equipment. Each jar with the plastic bag liner was filled with 500 milliliters of tap water. Tap water from Baton Rouge artesian wells had a pH of 7.6, alkalinity of 8 p.p.m., and total dissolved solids of 205 p.p.m. Since the plastic bags did not remain taut with this quantity of water, test animals could remain at or near the air-water interface easily. It was not necessary to aerate the water for the test animals under this arrangement. Water temperatures varied with air temperatures in a ventilated room and ranged between 16 and 32° C. during the test periods. This range of temperatures is not unusual in the natural environment of the red crawfish.

Observations on survival were made after 24-, 48-, and 72-hour exposures to each compound tested. Insecticides tested were prepared by serial dilutions of stock concentrations. Following the first series of tests in which the concentrations that gave 100 percent mortality in a 24-hour period were determined, lower concentrations were tested.

Control animals were included in each series of tests. Based on survival in different concentrations of each insecticide during 24-, 48-, and 72-hour periods, the TLm (median tolerance limit) values were determined by straight-line graphical interpolation of points representing percent survival of crawfish and logarithmic concentration of insecticide (American Public Health Association, 1963).

The insecticides used in these studies were obtained directly from the chemical companies as materials for field use. A formulation of 0.075 percent Mirex fire ant bait on corncob grits was also tested. The trade and technical names for each of the insecticides tested are listed in Table 1.

RESULTS

There was no detectable difference in the toxicity of any insecticide to male or female crawfish; therefore, the data for both sexes were pooled in plotting percent survival. Mirex, malathion, and dimethoate caused no mortality of crawfish at the concentrations tested. Mirex was tested as a bait in 600 milliliters of water at 0.0004, 0.002, 0.01, and 0.1 p.p.m. or 1.5, 7.0, 35, and 345 pounds per acre respectively of the 0.075 percent formulation. Malathion was tested in concentrations up to 20 p.p.m. This concentration is above the TLm reported for most fishes except fathead minnows (Pickering et al., 1962). Dimethoate was tested in concentrations of 20 p.p.m. and produced no mortality of crawfish. Comparable data on the effects of dimethoate on fishes or other aquatic organisms are not available.

Seven insecticides which were considered for use in controlling the forest tent caterpillar or that are being used to control rice and sugar cane insects were lethal at levels to which crawfish may be subjected during field insect-control programs (Table 2). No known comparative data on the effects of these seven insecticides to crawfish are available. Endrin and DDT, which are extremely toxic to fishes, were less toxic to crawfish. Methyl parathion and sevin were reported by Henderson et al. (1960), Pickering et al. (1962), and Loosanoff (1960) to be less toxic to vertebrates than to invertebrates. Studies on arthropods have shown that the toxicities of both chlorinated hydrocarbons and organophosphate insecticides to Daphnia magna Straus (Anderson 1960) and crabs (Loosanoff, 1960, and George et al., 1957) vary widely.

The TLm values for 24, 48, and 72 hours indicate that DDT, endrin, sevin, and methyl parathion were very toxic to crawfish. The immediate reaction of crawfish to methyl parathion was evident at less than 1 p.p.m., and death occurred in less than 3 hours. Contrary to the comparatively short stability of methyl parathion on crops, later tests with methyl parathion in brackish water from the Gulf of Mexico revealed that concentrations of 0.5 p.p.m. remained toxic to young blue crabs, Callinectes sapidus Rathbun, and juvenile brown shrimp, Penaeus aztecus Ives, for at least 45 days. Similar results were obtained in aquaria with constant aeration and in two 1/3-acre ponds located in highly organic marsh soils.

Tests with the same concentrations of insecticides in plastic bags and in glass jars indicated that survival rates were slightly higher in endrin and DDT formulations when placed in the plastic bags. Reduced toxicity of chlorinated hydrocarbon insecticides in polyethylene containers was reported previously (Anonymous, 1961). However, no differences in survival were noted for Dibrom and Bidrin regardless of the container used. It is believed that the adsorption effects of the plastic bags would depend upon the type of insecticide, volume of the solution, and the chemical properties of the test water. The plastic bags apparently reduced the toxicity of endrin and DDT to crawfish by TLm values of less than 0.5 p.p.m.

During the preliminary tests to determine the critical toxic ranges of the insecticides, two or three crawfish were placed in each container. Higher mortality rates were noted for the control animals than for the anima in sublethal concentrations. The higher mortality rates o the control animals were believed to be the result of cann balism. The sublethal insecticide dosages may have affect feeding of the test animals or they may have retarded molt thus reducing cannibalism. It became evident that insecticidal effects on crawfish could not be tested with more th one animal in each container. However, the crawfish may be an excellent animal for testing the effects of sublethal concentrations of insecticides because reduced mortality o treated animals where more than one animal is used per container may be indicative of effects on growth or endocrin changes.

Field experiments for control of the forest tent caterpillar were conducted in 1961 and 1962 in an area with high population of red crawfish. Bidrin at 0.15 and 0.25 pound and phosphamidon at 0.5 and 1.0 pound per acre appar ly did not kill any crawfish, fish, or terrestrial wildlif other than insects. Crawfish, fish, and frogs found in th test area were confined in wire cages which were placed in water 10 inches deep during and following the aerial applic tion of phosphamidon and Bidrin. Water in the test area ranged from 1 inch to 6 feet in depth. At the rates of application used, concentrations of insecticide would have been about 0.04 to 0.08 p.p.m. for Bidrin and 0.15 to 0.30 p.p.m. for phosphamidon, assuming that all of the material reached the water. No detectable mortality occurred as a result of this test program (Oliver, 1963).

The selection of phosphamidon and Bidrin offered an effective level of safety to other aquatic animals. These insecticides are effective as systemic insecticides for the control of the forest tent caterpillar on bottomland hardwood trees. Morris and Orr (1963) reported effective field control of the tent caterpillar with DDT; however, bird and fish losses were reported within the sprayed areas. In addition, areas of forest tent caterpillar infestations are also major headwater drainages for the commercial oyster and shrimp fisheries of the Gulf of Mexico. Loosanoff (1960) has reported the serious effects of DDT upon commercial shellfish and shrimp.

Table 1. *Trade names and chemical descriptions of 10 insecticides tested in bioassay on the red crawfish,* Procambarus clarki *(Girard)*

Common or trade name	Compound or technical description (Kenaga, 1960)
Malathion	0,0-dimethyl S-(1,2-dicarbethoxyethyl) dithiophosphate
Methyl parathion	0,0-dimethyl 0-p-nitrophenyl phosphorothioate
Sevin	1-naphthyl N-methylcarbamate
Dibrom	1,2-dibromo-2,2-dichloroethyl dimethyl phosphate
Bidrin (SD 3562)	2-dimethylcarbamoyl-1-methylvinyl dimethyl phosphate
Phosphamidon	2-chloro-2-diethylcarbamoyl-1-methylvinyl dimethyl phosphate
Dimethoate	0,0-dimethyl S(N-methylcarbamoyl-methyl) phosphorodithioate
Endrin	1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,-endo-endo-5-8-dimethanonaphthalene
DDT	dichloro diphenyl trichloroethane
Mirex	dodecachlorooctahydro-1,3,4-metheno-2H-cyclobuta(c,d)pentalene

Table 2.- *TL_m (median tolerance limit) values for seven insecticides tested on red crawfish,* Procambarus clarki *(Girard)*

Insecticide	Number of crawfish tested	TL_m (p.p.m., technical grade)		
		24-hour	48-hour	72-hour
Phosphamidon	120	20.0	8.0	5.5
Dibrom	64	6.0	4.0	4.0
Bidrin	128	5.5	4.0	3.0
Sevin	36	5.0	3.0	2.0
DDT	58	0.6	0.6	0.6
Endrin	56	0.4	0.3	0.3
Methyl parathion	80	0.05	0.04	0.04

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MR. STEIN: Thank you.

Are there any comments or questions? Mr. Trygg?

MR. TRYGG: I have one comment on the matter of the testimony before Senator Ribicoff on milk.

I don't know what preceded this -- I haven't read the testimony -- but I suspect from the terminology here that they were referring to the New Orleans water supply, per se, that is, the water we would drink in New Orleans.

DR. NEWSOM: This, I think, is right, Mr. Trygg.

MR. TRYGG: Apparently Mr. Larrick was not familiar with what was going on. I am sure he did not know better than this, but the sample run was on two one-liter samples. I personally made sure that they got to Cincinnati for their analysis.

DR. NEWSOM: I have no comment on it.

MR. STEIN: Are there any further comments or questions?

(No response.)

MR. STEIN: On Page 8 of your statement, Dr. Newsom, you say:

> "On the basis of the data, endrin appears to enter the body through the intestine as a result of the fish's drinking water. Very young fish are

"resistant to endrin, probably because their mouths are not functional and the endrin does not get into the intestine."

I seem to recall that in response to a question by Mr. Wood, Dr. Mount said that it was his opinion that Endrin was getting in through the gills.

DR. NEWSOM: This is correct, sir.

MR. STEIN: He did not say on the basis of two and a half hours that this could get into their system by drinking.

DR. NEWSOM: You are exactly right, Mr. Chairman, but this is also Dr. Mount's -- I am quoting directly from Dr. Mount's publication. He is the one to answer this, not I.

MR. STEIN: I think he has answered it.

DR. NEWSOM: I would be interested to know how the information which came about in three months would be allowed to outweigh that information which required almost two years, I believe, Dr. Mount to get.

MR. STEIN: Now, we have one other question -- do you want to answer that, Dr. Mount?

DR. MOUNT: Yes, I think I should.

I listened very carefully to what I had written several years ago. I think I remember most everything that I said, and I believe that I would stand on what I said then. If I had to write it now I would say it now, with the possible exception of this point, and I am not sure yet which way it gets in. It could be either way.

I think that we have more data now in regard to rapid acute exposure than we had at the time. It still may enter that way. I don't know.

The only other thing I would say in this regard -- and I think we must bear this in mind, not particularly in regard to your comment, but in regard to everything that has been said -- is that none of us really know what the actual concentration of Endrin in the river was. We are overlooking the fact that these are minimum concentrations that have been expressed, but I think in much of our thinking we are taking them as the maximum concentrations, and until we know that I don't think that this kind of speculation about whether the concentration of Endrin in the river was X or Y is pertinent.

MR. STEIN: Thank you, Dr. Mount.

Now, Dr. Newsom, I am not sure I understand this other point you raised. I don't know whom we have high up in the Public Health Service here, but as I understood you, this report was sent to you and at least three others.

It does not seem to me that at least once it gets started with this kind of distribution, anyone was keeping that kind of report confidential.

Dr. Grzenda, who handled that thing? Do you know?

DR. GRZENDA: Who was in charge of the study?

MR. STEIN: No, the report.

DR. GRZENDA: It was written by Dr. Lauer, I believe. Yes, Dr. Lauer wrote it.

MR. STEIN: I think the sole issue was why the report wasn't made available to the Department of Agriculture.

Was this report in fact made available to the Department? Is Mr. Coulter here?

Mr. Coulter, can you come up? Mr. Coulter is the coordinator for this in Washington. Perhaps he can shed some light on it. I don't know.

DR. NEWSOM: My concern is that I was denied the permission to put this in evidence at the Department of Agriculture hearings. That was my concern.

MR. STEIN: He may be the man who can answer this.

DR. NEWSOM: I hope so.

MR. STEIN: At your request, Dr. Newsom, we are going pretty high up in the echelons of the Public Health Service.

MR. COULTER: The report that you received is a summary of a report which is in the review process, and I believe that you received a letter stating that the report the summary was taken from was in a draft form.

Is that correct?

DR. NEWSOM: No, sir, I did not.

MR. COULTER: At any rate, your request duly came down through all the high channels in Washington in the Public Health Service. It arrived at my desk. A decision had been made in regard to the testimony before the Department of Agriculture.

However, we conferred with the Department of Agriculture, explained the contents and the nature of the report, explained that that report had not been issued as a Public Health Service report at this time, and we could not make it a public document before that committee.

However, we did agree to give to them the draft of the report which was in Washington on my desk at that time, complete with all the comments and annotations of the reviewers who had gone over it at that time.

It was my understanding that the Department of Agriculture was satisfied that this would provide them the information they needed for their consideration.

It is also my understanding, by a copy of the letter that I got addressed to you, that you had been assured that the Department of Agriculture had the information and that it was sufficient for their purpose.

DR. NEWSOM: I should like to comment on that, if I may.

I have not received any such letter. It may be on my desk when I get back, but with regard to the statement that this thing is not a complete report, I can understand this. It is labeled as a progress report, but there are reams of evidence that have been presented during these hearings, the agricultural hearings, and this, which are far more premature in my opinion than this.

MR. STEIN: Sir, as I understand that report, and maybe you can tell me, doesn't that report deal with another drainage basin? It doesn't deal with the Mississippi River.

DR. NEWSOM: This is correct. It deals with Bayou Yokely.

MR. STEIN: Is that a part of the Mississippi Drainage Basin?

MR. LAFLEUR: No. How does it get in the Mississippi?

DR. NEWSOM: I am sorry; I stand corrected.

MR. STEIN: I suggest, Dr. Newsom, you know we can come in on a purely intrastate matter if you can prevail on your governor to ask us in. We would be delighted to come in.

DR. NEWSOM: We would be delighted to have Dr. Nicholson and his group come in with his suggestion that we need some help.

MR. STEIN: We understand this, but in an enforcement jurisdiction, as I understand it, we can only come in on your own initiative on intrastate rivers.

Now, if you want to extend the case, perhaps you can prevail upon your governor to ask the Secretary to come in. I am sure we will be glad to go to Bayou Yokely, or any other intrastate water in Louisiana that your governor may invite us to come into.

DR. NEWSOM: Mr. Chairman, you have already been on Bayou Yokely with us.

MR. STEIN: That was part of an enforcement action, sir.

Our enforcement jurisdiction is very, very limited.

DR. NEWSOM: We are after facts in this thing, it is my understanding. We have quite a number of them which have been presented in a report. I suggest that these are pertinent, and it is my opinion they are quite pertinent and should not be suppressed.

MR. STEIN: As a matter of fact, sir, as I again look at the record, the report was sent to at least four people in Louisiana. It was made available to the Department of Agriculture for its consideration.

As far as I can see, it is a public document, though a progress report, and I don't see any pattern of a suppression. Maybe I didn't hear something you said.

DR. NEWSOM: May I enter this report in this hearing?

MR. STEIN: As an exhibit?

DR. NEWSOM: No. May I present this at this meeting?

MR. STEIN: As an exhibit?

DR. NEWSOM: In any manner that I can get this on the record.

MR. STEIN: You can put it in as an exhibit, if you wish. You can put anything in as an exhibit.

I would suggest, though, sir, that it should have some pertinence to the area we have under consideration in it. In the Federal Government, we have no desire to extend our jurisdiction to pure intrastate waters of Louisiana, and we certainly will not do so without the specific request of the governor of your State.

I think this is a very, very jealously guarded prerogative of the States and of States' rights, and we would be the last to breach that.

Thank you.

MR. WOOD: Mr. Chairman?

MR. STEIN: Yes, sir.

MR. LAFLEUR: I want to say for the record I agree with you, and I am going to help you abide by that last statement you just made.

MR. WOOD: Mr. Chairman, there has been some data presented here today that had not been on Mississippi catfish, and I don't believe they used Mississippi dilution water.

If there is any possibility of this data or information in that report that might be pertinent to our question, in the Mississippi River in Louisiana or at the Arkansas border, or wherever it might be, I think it might be well if the conferees were supplied with this information.

MR. STEIN: I would be glad to have the conferees have any pertinent data, if this is pertinent in the opinion of our investigators.

If Dr. Newsom considers it pertinent, he can make it available to the conferees. I have no idea what is in it.

MR. WOOD: I don't either.

MR. STEIN: Let me ask Mr. Coulter.

You have no objection to making this available to the conferees, do you?

MR. COULTER: None whatsoever.

MR. STEIN: All right. This will be done.

Dr. Newsom, I had one further comment before you left, and just one.

I read your testimony before the Agricultural Committee. This involves the last paragraph of your prepared statement. I am glad to see that it is somewhat extended.

Before that you said that insecticides should not be discontinued, or should only be discontinued if such uses involve a hazard to human health.

I see that in this statement you have added "or permanent damage to wildlife populations."

Then you say:

> "However, it is also our position that it should be established without reasonable doubt that such hazards are involved before any action is taken which would result in withdrawal from use, or which would impose severe restrictions upon the use of any insecticide."

I appreciate your point of view, but the same kind of proof must be adduced, where you must prove a man guilty beyond a reasonable doubt to convict a man for murder. However, I might suggest that some people may have another view, that it is up to the manufacturer to indicate that his product does not cause the damage before he puts it on the market.

MR. COULTER: Mr. Chairman, I would like to make a statement for the Public Health Service.

MR. STEIN: Let's finish this first.

MR. COULTER: All right.

DR. NEWSOM: I have no comment.

MR. STEIN: All right, Mr. Coulter.

MR. COULTER: I stated a copy of the letter that I received from the Department of Agriculture was addressed to Dr. Newsom. I was wrong. The telegram apparently was signed by another official at the University and the letter went to him. I stand corrected. I believe it is Everson.

DR. NEWSOM: Dean Everson.

MR. STEIN: Thank you very much, Dr. Newsom.

Mr. Lafleur?

MR. LAFLEUR: Before I call on the next speaker, I would like to find out if there is in the audience a Mr. Charles Bosch.

(No response.)

MR, LAFLEUR: In that event, then the last speaker on the list is Mr. Lloyd Lauden, Agronomist with the

American Sugar Cane League.

STATEMENT OF LLOYD L. LAUDEN, AGRONOMIST
AND FIELD REPRESENTATIVE, AMERICAN SUGAR
CANE LEAGUE OF THE U.S.A., INC.

MR. LAUDEN: Mr. Chairman, ladies and gentlemen:

My name is Lloyd L. Lauden. I am Agronomist and Field Representative of the American Sugar Cane League of the U.S.A., Inc. The League is a Louisiana non-profit organization whose membership consists of more than 95 percent of the Louisiana sugar cane processors.

I appear for the purpose of presenting testimony and data to show to some extent the value of pesticides to agriculture, the nation, and to the Louisiana sugar industry. I also appear to request that those charged with the responsibility of gathering facts and informing the public on matters pertaining to pesticides be sure of what they say. The public is easily alarmed and can be panicked by fear sounding phrases and sensationalism. We also ask that decisions be made on the basis of only truth and facts which are the result of a sound research program.

I believe the people of this nation are entitled to hear all the facts about pesticides. I know they want to hear them. Without pesticides commercial production of many crops would be almost impossible. Sweet corn would be wiped out in the entire Southern States. Peaches and cherries would probably disappear from the market. Commercial production of strawberries and citrus would be impractical. Canned juices would not be plentiful. Diseases of grapes, cranberries and raspberries would keep these crops from the market.

The elimination of pesticides would put an end to much of the winter production of vegetables in the South and Southwest. Even egg and broiler chicken production would become impractical. Maggots would fill both grapefruit and oranges were it not for the use of pesticides to control the Mediterranean fruit fly. In 1956 the Florida citrus industry was threatened by an outbreak of the fruit fly and this industry was saved only by a timely and all-out spraying program. The Mediterranean fruit fly, like many other insects that do damage to U. S. crops, is not native to this country. Foreign insects which enter this country increase at a rapid rate. This is because their natural enemies are not here to help keep them under control.

According to pest control experts it would be impossible to control flies, cattle grubs, and other livestock parasites without pesticides. The loss of the use of pesticides would reduce meat production and skyrocket meat prices. Additionally, without insecticides, corn and other feed for livestock would be in short supply rather than in surplus. This would further help to increase the cost of meat.

Human and animal food in general would suffer from the ravages of pests without pesticides.

Worms and maggots in and on vegetables and fruits, and on the dinner table, are not a pleasant sight, but the people of this nation can be sure that without the use of pesticides they will share their food with these pests, sometimes at the table, and, in addition, they will be forced to pay more for the food they eat. Some of you here can remember when worms were quite common in vegetables. You may all remember when it was difficult to find an apple without a worm in it -- or a half of a worm in it.

It would be time-consuming to substantiate what I have said about the aforementioned crops with entomological data, but much of what I have said has already been said by two of this nation's outstanding authorities, Agriculture Secretary Mr. Orville L. Freeman and Dr. Byron T. Shaw, Administrator, Agricultural Research Service, United States Department of Agriculture.

Were it not for pesticides this nation certainly would not be as well fed, clothed, and sheltered. The loss of pesticides would bring about more poverty and hunger. Without an effective method to control pests, the price of some foods would soar out of the reach of many. The end result would be that most of the people of this nation would have to pay more for a less appetizing meal, and some people would occasionally be forced to go without food.

It is a fact that we are now the best fed people on earth. Mr. Khrushchev would like to boast that Russia held this position. We must be sure that the action we take here is absolutely right before the decision is made to lose this most effective tool of agricultural production which would surely bring about the rapid loss of our coveted number one position as the best fed people on the face of the globe.

The Louisiana sugar industry is an important segment of the economy of the State of Louisiana. Normally, about 300,000 acres of sugar cane for sugar are grown in 18 parishes (counties) of Louisiana by 5,500 farmers who employ approximately 20,000 workers. The cane is ground by 46 factories located throughout the cane area. The raw sugar produced at the cane factories is refined at seven refineries located in Louisiana and one refinery in Texas. In addition to the raw mills and refineries, there are other manufacturing plants in the State of Louisana that make products from bagasse and blackstrap molasses, two important by-products of the sugar industry.

Although Louisiana in the past normally had about 300,000 acres in cane, the 1963 crop was 320,000 acres and it is now estimated that 350,000 acres are in cane for the 1964 crop. In 1963, Louisiana produced more than 9 million tons of cane and about 760,000 tons of sugar, raw value. The value of 1963 cane crop at the first processing level alone is calculated to be $158,000,000, and cane farmers received approximately $101,000,000 of this amount. Sugar cane is the State's number two crop in value.

As Agronomist for the League, I work in cooperation with the Louisiana Agricultural Experiment Station and the U. S. Department of Agriculture in a cane variety development program. My principal responsibility is the inspection, evaluation, and increase of many unreleased varieties of cane placed on 48 sugar cane farms geographically located throughout the cane belt. The results of the inspections for agronomic characteristics, diseases, and insect damage help in the evaluation of a new variety. This work has afforded me an excellent opportunity to observe the drastic effect of insect damage to sugar cane. It has also given me the opportunity to compare the value of different insecticides. I can say without the slightest fear of being contradicted that Endrin is the most effective insecticide ever used on the Louisiana cane crop.

Prior to the advent of Endrin in 1958, heavy sugar cane borer infestations in many areas of the cane belt drastically reduced yields of cane per acre. A five-ton loss per acre in areas of heavy borer infestation was not uncommon. Yield data published by the Louisiana State Experiment Station and the U.S.D.A. proves this beyond any doubt. The larvae of these insects tunnel their way into the cane stalks, eating, destroying, and stunting entire stalks of cane. This type of damaged cane usually falls to the ground and is never harvested. If the stalks stand erect and are mechanically harvested, they reduce the quality of the overall product. Even under conditions of lighter or lower infestation, the damage from this insect is considerable. The physical damage caused by the tunneling of the insect breaks apical dominance in the sugar cane plant and therefore the lateral buds located at the nodes sprout and begin to grow. This condition causes a reduction in sugar content in the cane and reduces the value of a ton of cane. Additionally, stalks are weakened by borer punctures and, therefore, break during mechanical harvest. Many of these pieces are never recovered and represent another source of loss.

Although Endrin has not been used over the entire Louisiana sugar cane acreage each year since 1958, it is conservatively estimated that without Endrin the average cane production for the State over the past six years would have been 10 percent lower. In 1963 a 10 percent loss would have amounted to $15,800,000.

The Louisiana sugar cane industry also makes use of other types of pesticides such as chemical weed control agents. Without these pesticides there is no doubt that this industry would suffer an additional loss greater than 10 percent.

Research and Extension Service workers, together with spokesmen from the American Sugar Cane League, have urged and encouraged the safe use of Endrin and all other pesticides. Although Louisiana cane growers and aerial applicators know that the pesticide Endrin is toxic to fish, there have been a few cases where it has inadvertently entered small streams while being applied and fish were killed shortly thereafter.

Cane growers use Endrin generally during June, July and August. Endrin is applied to cane only on rare occasions during the first few days of September. Applications of Endrin are made at no other time of the year in the Louisiana cane belt. I know of no incident where fish and wildlife has been hurt by the other pesticides used on sugar cane in Louisiana.

Virtually no water run-off from Louisiana reaches the Mississippi River, which is leveed on both sides. The last year the Red River discharged into the Mississippi was in February, 1945, and then only for nine days and at a very slow rate. This information can be found in a publication by the U. S. Army Corps of Engineers entitled "Stages and Discharges: Mississippi River and its Outlets and Tributaries."

The Louisiana Stream Control Commission works with and records data on matters pertaining to pollution abatement and the League obtained from this agency a statement regarding pollution of the Mississippi River. Because of its pertinence, I will read for the record the entire statement.

"From: Robert A. Lafleur, Executive Secretary
Louisiana Stream Control Commission

Dated April 9, 1964

Subject: Fish mortality as related to agricultural pesticides in the State of Louisiana.

"Based on observation and all other information to which this agency has access, it is our judgment and conclusion that the A-typical type of chronic "fish die-off that has been experienced, observed, and investigated in the State of Louisiana has its origin in the Mississippi River as this river flows into Louisiana from areas north of Louisiana. This particular A-typical and chronic mortality is confined and/or restricted to the Mississippi River Drainage Basin, which includes the Mississippi River and that part of the Atchafalaya Basin into which the Mississippi River can and does flow. There is, to the very best of our information, virtually no surface drainage or run-off to the Mississippi River Drainage Basin from the State of Louisiana.

"More specifically, it is the judgment and conclusion, based on our best information, that no other drainage basin or stream in Louisiana has been affected in the aforementioned manner with respect to the fish mortality which occurred during the winter of 1960 and has continued on an intermittent basis during the colder winter months since that time. Such streams in Louisiana include Bayou Teche, Bayou Black, Bayou Lafourche, the Sabine River, Calcasieu River, Ouachita River, Red River, Tensas River, Amite River, Black River, "Techefuncte River, Bouge Falaya River, Pearl River, and all other lesser intrastate streams of the State of Louisiana.

"It is a fact that fish kills as a result of pesticide on a shock-dose lethal basis have occurred in some Louisiana streams such as Bayou Black, Bayou Choctaw, and possibly others. It is noteworthy and I hasten to add, that these fish kills are characteristically different from the previously mentioned A-typical chronic kills in the following respects:

"The lethal shock dose kills have been observed to be species non-preferential and are more often than not total and massive in nature with respect to all species of fish life. The chronic A-typical fish die-off in the Mississippi River is characterized by, among other things, a species preferential type of die-off.

"In the fresh water areas of the Mississippi virtually all species of fish observed affected included bottom feeding, or dwelling fish, such as buffalo, catfish, fresh-water drum, gizzard, and a scattering of gar fish. In the brackish estuarine areas of the Mississippi River, surface feeders such "as menhaden, speckle and white trout, and mullet are the species being affected.

"In summary and conclusion, and for purpose of emphasis, it can be said that the A-typical chronic fish die-off observed in the Mississippi River has not stemmed from use of pesticide within the State of Louisiana."

The American Sugar Cane League of the U.S.A., Inc., respectfully requests that the U. S. Public Health Service undertake an extensive survey and study program to determine all the facts in this matter before a decision is made that could possibly do an injustice to agriculture in general and weaken our nation.

That concludes my statement.

Closing Statement

MR. STEIN: Thank you very much for a very eloquent statement, Mr. Lauden.

Are there any further comments or questions?

(No response.)

MR. STEIN: If not, we will try then to summarize and discuss and see what areas of agreement we can get at. I know several of the conferees may have to leave.

I think we can all agree, unless there is a dissent, that the Mississippi River in the area covered by the conference is an interstate waterway within the definition of the Federal Water Pollution Control Act, and a navigable stream.

The next conclusion I think we can possibly agree upon is, in accordance with the indication from Mr. Lafleur representing the official water pollution control agency of the State of Louisian, that there were two types of fish kills occurring in Louisiana. One was the type of fish kill which caused immediate death to fish and was noted after the application of Endrin, and the other was what Mr. Lafleur refers to as the atypical type of fish kill in his letter and a species-preferential type of die-off.

Most of the fish that were found to be dead or dying as a result of our investigations, according to the Department of Health, Education, and Welfare and Public

Health Service investigators, were catfish.

The determination and the conclusion of the Public Health Service investigators was that the pesticide Endrin was responsible for the fish kill observed in the Mississippi and Atchafalaya Rivers in Louisiana during the fall and winter of 1963-1964. I want to emphasize that this refers to the Mississippi and Atchafalaya Rivers, and does not extend out into the Gulf, and presumably does not refer to the menhaden.

Is this a statement that Louisiana would agree with or not as a conclusion?

MR. LAFLEUR: I think, Mr. Chairman, since the samplings have not gone beyond the mouth of the rivers and into the Gulf, we will only go that far in this discussion.

MR. STEIN: That is right. That is all I have said.

However, would Louisiana agree with that as a determination?

MR. LAFLEUR: Yes.

MR. STEIN: How about Mississippi?

MR. JOHNSTON: Yes.

MR. STEIN: Arkansas?

MR. WOOD: I think we can agree that apparently it was a contributing factor, at the least.

MR. JONES: There may be other factors in there. You have a very flat, definite statement.

MR. STEIN: No. I think both Louisiana and Mississippi agree with that statement.

I think we could all agree that it is a contributing factor, and your position is that it is a possible cause?

MR. JONES: Just to say that it is is too positive. There may be some other factors. I don't know.

MR. STEIN: What would you say, Mr. Svore?

MR. SVORE: It is a contributing factor.

MR. STEIN: Would you go along with the investigators' statement that the pesticide Endrin was responsible for the fish kill?

MR. SVORE: I would go along with that.

MR. STEIN: All right. Well, I think what we will do here is that we will note this as part of the summary of agreement, with the qualifications of Arkansas and Tennessee on that.

The next point we have is that industrial wastes and drainage from contaminated areas in and near Memphis, Tennessee, are sources of Endrin pollution in the Mississippi River.

Is there any dissent from that on the basis of the information presented here.

MR. LAFLEUR: Would you run through that again, please?

MR. STEIN: I think it might help the conferees if you picked up the big report and looked at the conclusions. It reads:

> "Industrial waste and drainage from contaminated areas in and near Memphis, Tennessee, are sources of Endrin pollution in the Mississippi River."

MR. JONES: There is one word there, Murray, and this is not playing on words --

MR. STEIN: Yes.

MR. JONES: Pollution would indicate toxic level in the Mississippi. There is no question on the source of Endrin, but the word "pollution" will depend on toxic limits.

MR. STEIN: That is right. I don't think we have any difference here. "Pollution" here means that it endangers health or welfare under our law.

This is the law we are operating under here. "Endangers" means to put in peril.

MR. JONES: But what level of Endrin is safe in the water?

MR. STEIN: The determination of the investigators, as I understood it, was -- and I think there was a recapitulation by Mr. Kittrell at the end -- that the Endrin sources from the Memphis area were a significant source of pollution.

MR. JONES: I can't agree on that wording. I want more information and I want to get it clarified.

There were a number of days where zero was reported. The last analyses were zero. Maybe it was all corrected.

MR. STEIN: I would say "was" instead of "are."

MR. JONES: Well, on some of the samples it was above the limit, yes.

MR. STEIN: Do you want to change it?

MR. JONES: What I would suggest to change is "are sources of Endrin," because there might be trace amounts. Then we are going to get in and find out these levels.

MR. STEIN: The question here is whether there are significant sources of Endrin.

MR. JONES: That is the whole question of the conference.

MR. STEIN: That is right. If there are not or have not in the past been significant sources of Endrin coming out of the Memphis area, then I think we can give them --

MR. JONES: In other words, you are pre-concluding that Velsicol killed the fish.

MR. STEIN: I did not say that at all.

MR. JONES: What other Endrin pollution could you refer to?

MR. STEIN: As I examined the reports of our people, it was indicated that about one-third of the Endrin probably came from the Memphis area, and about twice as much of the Endrin came from sources other than that.

In your law, as well as ours, the people responsible for pollution are jointly and severally liable, if they all contribute, by all means, so I think the reports from the Public Health Service indicate that Velsicol or the Memphis area was the sole source of pollution.

MR. JONES: What you are saying here is that the amount of Endrin coming out of the Wolf River and from the Memphis sewers is of toxic concentration.

MR. STEIN: Was or is a significant source in combination with other sources of Endrin, and was in toxic concentrations.

That is what we do in pollution cases. As I say, there is this concept of being jointly or severally liable. If you take ten sources, each by themselves, not causing the damage, but all joining together and causing damage, each one of the ten is considered responsible.

MR. JONES: You can go ahead, but I vote "no" for that sentence.

MR. STEIN: Do you have any recommendation on what we can agree upon?

MR. JONES: My difference is with the word "pollution." This we are going to have to find. We are not going to settle this thing now. We have to get far more data there, and so does everyone else.

Now, there was Endrin coming from that source. However, if you look at your Paragraph 3, which says other sources than the Memphis area not yet identified, I think that will help me make my point. I don't have any question on that.

MR. LAFLEUR: In response to the request by the State of Louisiana for technical assistance, the letter of response contained, and I read in part:

> "Three suspected avenues of entry into the water are under investigation, drainage from farmlands, application and handling practices, and manufacturing and formulating processes."

MR. JONES: All right. We will change this to "suspected source of pollution," if you want to, which is what the letter states. I will go along with that.

MR. STEIN: We have had many statements here.

If it is agreeable, we can strike the word "pollution."

MR. JONES: Strike the word "pollution" or change it to "suspected sources."

I am not thoroughly convinced on this concentration. As soon as I unravel this big report and all these papers and get some figures, it may show that.

MR. STEIN: If you don't want to draw the conclusion, we can strike "pollution."

MR. JONES: Strike the word "pollution."

MR. STEIN: All right. Then we are in agreement.

MR. JONES: I am saying, in other words, that Endrin per se is not necessarily pollution below a certain concentration. This is what we have to determine. Are we below that level, or are we two or three or four times above? If so, we had better find out.

MR. TRYGG: You don't really mean all that, because that would mean you fellows could affect the whole amount of the stream.

MR. JONES: No. If we give you a high percent, I want to be sure.

MR. TRYGG: I don't mean necessarily with the idea of the pollution, but I don't want you to feel that you can put limited amounts in.

MR. JONES: No, sir. If we give you a high percent, I don't think we will have any trouble arguing on the percent, I assure you.

MR. STEIN: All right.

MR. LAFLEUR: May I ask a question?

MR. STEIN: Yes.

MR. LAFLEUR: Would you disagree with this description with respect to the Memphis area?

I am reading again from a letter here:

> "We have already identified the significant source of contamination from a manufacturing plant in Memphis."

MR. JONES: From whom is that letter?

MR. LAFLEUR: Public Health Service.

MR. JONES: By whom?

MR. LAFLEUR: Signed by James Coulter.

MR. JONES: That doesn't mean a thing. He told the press too that there is a considerable amount of Endrin being dumped at Memphis.

All I am arguing about is concentration. Don't pre-conclude this thing until you wait for the facts. If we find this definite concentration there, we will be the first to admit it to anybody.

MR. STEIN: Really, you know I hate to keep saying this, but I have to in order to protect the record and protect our men.

MR. JONES: I want to straighten out the record.

MR. STEIN: I wasn't present when Mr. Coulter talked to the press, if ever. I don't know that you were either. I don't know that he told that to the press.

MR. JONES: All I am saying is what the press said that he said.

MR. STEIN: That is different. If you want to say that, that is fine, and we will let the record stand.

MR. JONES: Get the record straight, but I never saw a denial or a letter to us or to you denying that he made such a foolish statement.

MR. STEIN: Well, I am not --

MR. JONES: Ask him.

MR. STEIN: I am not prepared to characterize statements.

MR. JONES: What did you say, Coulter?

MR. STEIN: Come on, really. I don't think we have to do this here.

MR. JONES: I am accusing him of a misstatement.

MR. STEIN: You may talk about a misstatement, but I don't think that we have ever directed a question about foolish statements to anyone here, and I don't think that is conducive to getting a response.

MR. JONES: Go ahead, then.

MR. STEIN: "3. The available data demonstrate that other sources than the Memphis area, not yet identified, contribute to the Endrin found in the Lower Mississippi drainage area. These other sources must be identified through further study."

Is this agreeable?

MR. LAFLEUR: Very much so.

MR. STEIN: All right.

MR. WOOD: Mr. Stein, in view of the wide latitude of variations and concentrations that have shown up at these varying stations at varying times of the year, I would like to suggest that that be changed to "may contribute to the Endrin found..."

MR. STEIN: If that is agreeable. Is that agreeable?

MR. WOOD: And that they should be identified through further study, and that the sources should be identified.

MR. STEIN: It says "must." You want to change "must" to "should"?

MR. WOOD: Either way.

MR. WAY: I think "must" is a better word here.

MR. WOOD: They must be resolved.

MR. STEIN: Let me get off the record here.

(Discussion off the record.)

MR. STEIN: All right. Let's see if we can go on.

> "4. Discharges of sewage and industrial wastes may cause pollution of an interstate nature and will require further study."

Is this agreeable?

MR. LAFLEUR: Yes.

MR. WOOD: Mr. Stein?

MR. STEIN: Yes.

MR. WOOD: The conference here today embraces the total drainage area of four States.

MR. STEIN: Yes.

MR. WOOD: And I think that possibly might be amended to read, "Discharges of sewage and industrial wastes to the Mississippi River..."

I can't envision some discharge of sewage or industrial waste, or both.

MR. STEIN: To the Mississippi River, whether it reaches that river by discharge through a tributary or not. Is that all right? I think Mr. Kittrell pointed out we always have that. A lot of these places discharge into tributaries. We don't want to get impaled on this main stem discharge.

If there is no effect on the Mississippi River, I would agree with you.

MR. JONES: How about that wording then?

MR. TRYGG: Before we talk about wording, when Louisiana asked for help here, I don't think we envisioned that we wanted you to check out the industries or the municipalities.

MR. STEIN: I know, but that is what the Secretary called the conference on.

MR. JONES: If we disagree, take out Item 4.

MR. STEIN: I have a suggestion which I think might meet, at least, the wording of Mr. Wood's suggested changes, and then you can decide whether you want it or not.

> "Discharges of sewage and industrial wastes may cause pollution of the Mississippi River of an interstate nature and will require further study."

MR. JONES: Then you are just spending money for another study.

I move that Paragraph 4 be taken out on the ground that it was not asked for here.

If you find that Memphis sewage affects you, let me know.

Closing Statement

MR. STEIN: Mr. Jones, I am confused. I don't think the State of Louisiana asked for an enforcement conference at all.

MR. JONES: Then what are we doing down here?

MR. STEIN: Because the Secretary called it on his initiative, as is clearly stated in the Federal Water Pollution Control Act.

Nothing was further from their minds, I think, than calling for an enforcement conference when they put in this request.

The first I knew about this was when I read the same article that Leary read.

MR. JONES: If we didn't have the press, we would be lost.

MR. TRYGG: You don't want that "will" in there in the last sentence.

MR. STEIN: What do you want there then?

MR. TRYGG: "May."

MR. STEIN: All right.

MR. TRYGG: How about that, Mr. Leary?

MR. JONES: I still suggest we take that out.

MR. TRYGG: How are we going to do it?

MR. JONES: We just vote.

MR. STEIN: No. We come to a consensus.

MR. JONES: Wouldn't there be a consensus of the vote?

MR. STEIN: No. In summarizing this, as I did in the first one, if there are disagreements, I will note what each conferee said and what the split is.

MR. JONES: How are we going to split if we don't vote?

MR. STEIN: We can poll you.

MR. JONES: I will vote no.

MR. STEIN: You don't want Paragraph 4 at all?

MR. JONES: No.

MR. STEIN: How about you people from Louisiana with your "may"?

MR. TRYGG: What are you polling us on?

MR. STEIN: Paragraph No. 4.

> "Discharges of sewage and industrial wastes may cause pollution of the Mississippi River of an interstate nature and may require further study."

MR. JONES: This involves the Gulf of Mexico too, maybe. That is interstate water.

MR. TRYGG: I don't know what we are being polled on yet -- whether we like the statement or whether we want to correct it?

MR. STEIN: Whether you agree to that as a conclusion of the Louisiana conferees.

MR. TRYGG: Obviously, it is true, but I don't like to see it in there. It is an invitation for you to come back, you know. We don't think we need you on this.

MR. STEIN: I understand.

MR. LAFLEUR: I have tried not to worry you for about three years, as a matter of fact.

MR. JONES: We have a double question, whether to send it as is or whether to send it as corrected, to affect the Mississippi only, or to take it out. You have a three-way question, I think.

MR. JOHNSTON: My main objection to the question is that you are talking about the Mississippi River in these four States, and we have to absorb the pollution upstream. I think it ought not to stop at the north Tennessee line. I think we ought to go farther north if you are going to do that, because, if the people up the river have used up the capacity of the stream to absorb municipal and industrial wastes, and so forth and so on, there is nothing left for us.

MR. TRYGG: You are talking about the entire rivershed now?

MR. JOHNSTON: Yes.

MR. STEIN: As I understand your suggestion, Mr. Johnston, you say that the discharges of sewage and industrial wastes may cause pollution of the Mississippi River of an interstate nature, and may require further study; but if that requires further study, consideration should be given to extending the area of jurisdiction to upstream States on the Mississippi River which may affect you?

MR. LAFLEUR: This is part of your report.

MR. STEIN: Is this your position?

MR. JOHNSTON: Yes.

MR. STEIN: Does Louisiana go along with that, or don't you want it?

MR. WOOD: Mr. Stein, could I comment one more thing on this?

MR. STEIN: Yes.

MR. WOOD: There hasn't been any testimony here today or yesterday, with one exception, with respect to any sewage discharges as being contributory to pollution. There hasn't been any evidence presented as to the effects of sewage discharges. I don't recall one single bacteria count. I don't recall evidence presented with respect to any other industrial waste discharges, save one, which the speaker felt was pertinent to the question at hand.

I think we may be getting a little outside the area of the conference there with this. At least, this is my personal feeling.

MR. STEIN: I understand your point, and I think we are not too much in disagreement here.

I don't think that this would deal with anything that does not affect the Mississippi River, but I do think, as Mr. Kittrell pointed out, there were many discharges that run into tributaries and creeks which might be just a little bit off the Mississippi River. Evidently they have some source there discharging raw sewage.

Now, I don't know whether that has any effect or not, but this was the question here.

MR. TRYGG: If they read this literally, "may require," and don't take it as an invitation, why, it is probably all right.

MR. JONES: "May" is an invitation.

MR. STEIN: If this goes in -- and I don't know if it will go in -- but if this does go in you can expect a study of the municipal and industrial wastes.

MR. JONES: I know. That is what is worrying me. We have our hands full figuring out who killed the fish down there, and I am quite sure the sewage did not. I think that all the records will show that.

If a detailed survey is to be made, one of these fancy things, on this whole section of the river, it is going to take manpower that needs to be on something else, plus a pre-conference on the Pigeon River, plus a pre-conference on the Chattanooga situation, which hasn't been mentioned yet.

We haven't time, with our staff, to waste time fooling with pollution down in that area unless it is pertinent. Let's save that for the next conference.

MR. STEIN: Wait.

MR. JONES: Let's vote.

MR. STEIN: Wait a minute.

MR. JONES: It will save time.

MR. STEIN: I know you have to go, but I think this is pertinent.

You will recall Dr. Anderson's statement of the Agricultural Research Center of the Department of Agriculture, and I think he made a very cogent point. I am not just taking his position, but I am talking about his point.

He said, "We cannot come up with a definitive answer on the effect of pesticides on fish unless we determine," -- and I am reading it -- "wastes from other types of industrial plants including refining plants, paper plants, pharmaceutical plants, chemical plants, and commodity processing plants; salinity in the lower reaches of the river; lack of oxygen; sedimentation; sewage; brine waste from oil and gas wells; and the presence of bacteria and other disease-causing organisms."

I think these are very cogent comments.

I don't know that we will ever put this situation to rest with this ever-present series of questions hanging over our heads, unless we come up and get the answers to them.

MR. JONES: Let's vote.

MR. STEIN: All right.

MR. JONES: Let's vote. I will go along and live with the majority, but not the minority.

MR. STEIN: All right. How do you feel about that?

MR. JOHNSTON: I am in favor of leaving it out.

MR. STEIN: I think we accepted the recommendation that you had that discharges of sewage and industrial wastes may cause pollution of the Mississippi River of an interstate nature, and may require further study, such study to take into consideration the loadings you are getting from up above the four States and the effect it might have on the river.

MR. JOHNSTON: Yes.

MR. STEIN: Is that agreeable to Louisiana too?

MR. LAFLEUR: That's right, and I might add too, Mr. Chairman, that anything that can be construed as contribution to pollution of the Mississippi River in Louisiana is not interstate.

MR. STEIN: We will fully agree with that.

MR. JONES: Isn't the Gulf of Mexico considered interstate waters?

MR. LAFLEUR: When it exceeds the three-mile limit.

MR. STEIN: There are two portions there, Leary. (1) It must be an interstate water, and (2) the discharge must originate in a State other than that in which the effect is felt.

I can't conceive that Louisiana in the lower reaches of the Mississippi River, from a casual look at the map, is affecting anyone but Louisiana, and we do not and have not up to now considered that interstate pollution. I think they will have to get rid of me before they do.

MR. LAFLEUR: I don't know of a State downstream from Louisiana at this time.

MR. JONES: No, I don't think so.

MR. STEIN: Is that agreeable, Mr. Wood?

MR. WOOD: I am not agreeable to opening the entire area of the State of Arkansas to a survey.

MR. STEIN: I don't think that is contemplated, sir.

MR. WOOD: Well, that is the way it reads.

MR. JONES: You have that "may" in there, Murray. Any time you get "may," it is contemplated.

MR. STEIN: I think this will be confined to the pollution of the main stem of the Mississippi River, but not to preclude courses which may be just a little bit off the main stem or may have an effect on the main stem.

MR. WOOD: Do you want to include water quality of each tributary to the Mississippi in order to find out whether there is something upstream?

MR. STEIN: I would agree --

MR. WOOD: Unless you confine this to the main stem, unless there are some indications that there is a problem off the main stem -- that is the whole point.

MR. STEIN: We will agree with that.

I want to do this now so we won't be again impaled on a technical operation. If a small tributary, a creek, is going into the main stem, and the discharge is, say, 100, 200 or 300 yards off that, and it flows into the Mississippi, that presumably will be considered going into the Mississippi. Right?

MR. WOOD: Right.

MR. STEIN: I think we are all in agreement on that.

MR. SVORE: I think we ought to comment a little bit on this. We shouldn't overlook the fact that we are talking about pollution in the river, that it kills fish, and that we ought to find out why this happens. We shouldn't be assuming that this is just in the main stem that this has happened.

I can see a possibility that this is more than just a few hundred yards up the stream one way or the other.

MR. STEIN: I think Mr. Wood's point was before we go up the stream.

MR. SVORE: This is a problem where you may have to go up a considerable way.

MR. WOOD: The possibility is there, but it hasn't been an indication on any of the main stems, or any of the tributaries, so I say let's check it.

MR. SVORE: If we are going to solve the problem, we can't tie our hands before we start.

MR. STEIN: I think Mr. Wood's statement, if I understood it, was that as a first step we check the entrance to the tributaries to the river. If there is no problem there, we don't go any further. If there is a problem, we will be there and see what we can do.

I don't think there is any problem on this one.

MR. WOOD: Let's say it that way.

MR. STEIN: We sure will.

The next is Paragraph 5, which reads:

"The presence of minute concentrations of Endrin in the treated water of the Vicksburg, Mississippi, and New Orleans, Louisiana, water supplies is a matter of concern. While acute effects on humans of this pesticide in water have not been detected the effects of continued ingestion of even these minute quantities must be evaluated."

This, of course, seems to affect Louisiana and Mississippi first. How do you feel about that, Mr. Trygg?

MR. TRYGG: I must bring this in, that you know the other division of the Service is actively working on this item. Now, how you handle it in this hearing I don't know, but they are actively working on it.

MR. STEIN: We are one service and one government. I mean, if you disagree with this --

MR. TRYGG: I agree with this statement. I just want to point out we are getting the action we hope to get.

MR. STEIN: I think that will be integrated, and it should be.

MR. TRYGG: It should be.

MR. STEIN: Are you in agreement with that, Mr.

Johnston?

MR. JOHNSTON: Yes.

MR. JONES: Yes.

MR. WOOD: Yes.

MR. STEIN: And I think this fits in with Mr. Lafleur's statement. He said that fish were dying in Louisiana.

We have the first conclusion that the pesticide Endrin was responsible for the fish kill, and I think your statement was in your letter that the toxicant was coming from outside of the State of Louisiana.

MR. LAFLEUR: Yes.

MR. STEIN: All right.

MR. LAFLEUR: Whatever the material is.

MR. STEIN: We have already indicated Endrin in the first conclusion.

Is this agreeable?

It will say the discharges of Endrin into the Mississippi River, on the way to the Mississippi River from sources outside of Louisiana, endanger health or welfare of persons in a State other than that in which the discharge originates.

MR. JONES: Have you got that written in there?

MR. STEIN: No. This is suggested. I took out the "Memphis, Tennessee, area."

I say discharges of Endrin from sources outside of Louisiana endanger health or welfare of persons in a State other than that in which the discharges originate.

Is that all right?

MR. JONES: Discharges of Endrin from outside Louisiana endanger? Is that where you skipped to?

MR. STEIN: Yes. All right?

MR. JONES: "Health and welfare"?

MR. STEIN: He meant "or." The statute says "or."

MR. JONES: But the report says "and."

MR. STEIN: He changed that when he went through it.

MR. JONES: Did he?

MR. STEIN: Yes. All right. Is that agreeable?

MR. LAFLEUR: Read the whole thing.

MR. STEIN: I would say:

> "Discharges of Endrin from sources outside of Louisiana endanger health or welfare of persons in a State or States other than those in which such discharges originate."

MR. JONES: It sounds awfully positive. You haven't established it yet, in my opinion. I think "probably" or "may" might be a better word.

MR. TRYGG: I am just wondering whether "appears" would be all right.

MR. STEIN: "Appears." Is that all right?

MR. JONES: Yes.

MR. STEIN: All right. "Appears to endanger." Is that all right?

MR. WOOD: Yes.

MR. STEIN: We will modify that.

By the way, let me tell you this: We will try to send a copy of the summary to all of you beforehand for your comments. All I ask is one thing. Please try to have your comments back in a week, because once this gets started, this is the section's operation and I can juggle the ball just so long.

The next point I think we have is we are dealing with sources of pollution from industry, land drainage, dumps, whether they are formulators or manufacturers.

The recommendation here is that they must be brought under control.

MR. JONES: Wait a minute. Doesn't that general statement cover everything without getting all the specifics?

MR. STEIN: Which one is that?

MR. JONES: The general one up here, that there appears to be some pollution, and, therefore, clean it up.

MR. STEIN: Where do we say that? We didn't say that yet. I would be delighted.

MR. JONES: You are going to have all of your boys going over all the dumps in the country.

MR. STEIN: No, we are not going to have all of our boys going over all of the dumps in the country. This is a State problem for you to handle within your own State.

MR. JONES: Well, good.

MR. STEIN: It is a clean-up.

MR. JONES: Good.

How about that "must" in there? You can't say "must" with our personnel.

You have personnel galore to run up and down. Can you assign us anyone?

MR. STEIN: I will tell you, to clean up that Memphis area you have full priority, and you can have anyone you ask for.

MR. JONES: I won't agree to that "must" in there. I can't say the town must clean up the dumps until I can prove that Endrin is coming from there into the stream, under our law.

MR. TRYGG: I was going to suggest "known sources."

MR. STEIN: "Known sources of Endrin pollution must be brought..." Do you agree with that?

MR. JONES: Yes.

MR. STEIN: "Known sources of Endrin pollution from industry, land drainage and mud deposits..." We will leave out "from the Memphis, Tennessee, area," "... must be brought under immediate control."

Is that all right?

MR. JONES: Yes.

MR. STEIN: Is that all right?

MR. JONES: You are reading this thing as if it were an order from the Secretary to the State of Tennessee.

MR. STEIN: No, sir. "Memphis" is stricken out.

MR. JONES: I object to these "musts" coming from a Federal agency. Make it "should" or "ought to be."

MR. STEIN: How about "are to be"?

MR. JONES: When you say "we must" --

MR. STEIN: How about "are to be"?

MR. JONES: "Are to be" is fine.

MR. STEIN: "A-r-e."

MR. JONES: We are going to clean up the stuff, but they can't tell us that we must do it.

MR. STEIN: Do you want "are to be"?

MR. JONES: I don't want to agree to "are to be" until I go down and talk to the city.

MR. STEIN: "Known sources are to be." You have to be satisfied they are known sources.

MR. JONES: Listen, I won't guarantee I will do anything, for the simple reason that I have just lost three engineers and we stand to lose three more. When we do, the program will probably fall. I won't agree that I will do anything next month.

MR. STEIN: We are not suggesting that.

MR. JONES: That "are" is suggesting that I do it, or the control board that is left.

MR. TRYGG: Will you do it before fall? That is when I will start worrying.

MR. JONES: I will do it before fall personally, but I won't agree to it being in there.

MR. STEIN: What do you suggest?

MR. JONES: I suggest we vote, and I will vote "no."

MR. STEIN: You can vote "no." I hate to go back to the Secretary --

MR. JONES: You don't have to come out like that. You didn't on the Norfolk situation. It was "the unanimous opinion of the conferees," so and so. It was not unanimous, but it was the majority of the conferees.

MR. TRYGG: Would you agree with a "should" instead of "must"?

MR. JONES: "Should" is fine, but this "must" I object to.

MR. STEIN: I will defer to our conferee here, but I think in view of what has been going out from some sources, I don't know whether you people want to go along with the "should." How do you feel about this?

MR. TRYGG: We have to do something about it.

MR. LAFLEUR: The thing is this: If we are going to suffer from this next fall, I am going to be boxed into a corner, and I don't want that.

MR. JONES: This won't happen, I guarantee, but a "must" in there is just one of these words that I won't agree to.

MR. STEIN: Do you want to say "be cleaned up within six months"?

MR. JONES: Let's have a vote on the question. I will vote "no," but get the wording in there.

MR. LAFLEUR: Let's make it "should."

MR. STEIN: How do you feel, Mr. Svore?

MR. SVORE: If we put "should" in there, this isn't going to solve anything. If you are going to solve it, it must be cleaned up.

MR. STEIN: It is to be cleaned up by the fall. Do you want to say that known sources of Endrin pollution are to be brought under control by the fall, and state a date?

MR. JONES: It ought to be cleaned up immediately. Why wait for the fall?

MR. STEIN: Of course. Make it "are to be cleaned up."

MR. JONES: They should be cleaned up immediately.

MR. STEIN: This is just a recommendation.

MR. JONES: Let's vote then.

MR. STEIN: How about you?

MR. LAFLEUR: I sure want it to be cleaned up.

MR. STEIN: All I can tell you, Bob, is that if we say "should" it has no force and effect.

MR. JONES: It doesn't have any force or effect either way, until you go into a hearing and into Federal Court. You know that.

MR. STEIN: Most of these cases have been solved by conference.

MR. JONES: This isn't a case; this is a conference.

MR. STEIN: When I speak of "case," I am using a generic term.

MR. JONES: All right. Put "should" there.

MR. STEIN: What do you want in there?

MR. JONES: If we can't get it cleaned up --

MR. LAFLEUR: If that man will promise me he is going to clean it up, I will buy his "should."

MR. JONES: If we have Endrin coming in there and we can't counter it by persuasion or by our own board order with our personnel at our board, we will request a Federal hearing. That I will guarantee you.

MR. LAFLEUR: Will you put that in writing?

MR. JONES: Surely, because our law says it in the first place. That is, on one condition, that I am still there to write the letter.

MR. SVORE: I don't see any difference in that from saying that it must be cleaned up.

MR. JONES: I don't like the "must" coming from the Secretary.

MR. SVORE: This is our recommendation.

MR. JONES: This isn't our recommendation; this is what the Secretary sends back as his conclusion, if he likes it. If he doesn't like it, he can send you the "must," but we are not going to buy it, though.

MR. SVORE: We are not going to solve the problem unless it is cleaned up.

MR. JONES: If it is coming from there. The dump you are talking about has already been covered, Murray.

MR. TRYGG: This is not necessarily a dump; this is the industry. Is that right, Leary?

MR. JONES: We are talking about the dump here.

MR. TRYGG: We are talking about the whole thing here. We are talking about known sources of pesticides, and if the industry isn't discharging, it isn't discharging. It might discharge in any one of three or four different ways.

MR. JONES: But, you see, we came down with no facts on what they were talking about. I have to go back and sit down with the company. It may take nine months to buy the equipment.

MR. STEIN: Do you have a suggestion?

MR. JONES: He has a word and I will buy it.

MR. STEIN: Would you read that?

MR. JONES: On Recommendation 1 there, that "Known sources of Endrin pollution from industry, land drainage and mud deposits be brought under immediate control." I will buy that.

MR. STEIN: That is fine. Are you in agreement with that?

MR. LAFLEUR: Read that again.

MR. JONES: "That known sources of Endrin pollution from industry, land drainage and mud deposits be brought under immediate control."

MR. LAFLEUR: All right.

MR. JONES: We are playing on words, but I am not going to go along with a "must."

MR. STEIN: That is all right. Let us go on. Look at the next one.

MR. SVORE: That is no sentence, but I will buy it.

MR. STEIN: We will make that into a sentence.

MR. JONES: If you put a "must" in, I am going to vote "no."

MR. STEIN: What has that to do with making it a sentence?

MR. JONES: It is according to what you put in to make it a sentence.

MR. STEIN: We will say that "The conferees agreed that known sources..."

I will send this to you.

MR. JONES: All right.

MR. STEIN: Now, as to No. 2, doesn't No. 1 assume No. 2 now? What are the other sources?

MR. JONES: What the rest of this report was on.

MR. STEIN: What do you think of No. 2?

MR. JONES: I don't like "must." Make it the same.

MR. STEIN: We will make it the same. "The conferees agreed that other sources be..."

MR. JONES: All right.

MR. STEIN: I think we have handled No. 3 previously. Is that right? That has been covered. All right.

Do you gentlemen have any further suggestions?

MR. WOOD: Just a minute. Is No. 3 as it is stated here, deleted?

MR. STEIN: Yes, it is deleted.

MR. WOOD: Off the record.

(Discussion off the record.)

MR. STEIN: Dr. Mount, will you listen to this? I think this has been zeroed in more.

The question is whether you still stand on your statement, which was as follows:

> "All positive evidence obtained in the past three months of laboratory studies indicates Endrin as the cause of fish mortality and no available evidence refutes Endrin as the causative

"agent. All the efforts to date to establish any other cause for the fish mortality have produced negative results."

That is at Page A-13. Is that right or wrong? You haven't retracted that, have you? Are you in agreement that that statement still stands?

DR. TARZWELL: Which statement is this?

MR. STEIN: A-13 in the blue book, the report on the investigation of fish kills dated April 6, 1964. That appears in the conclusions.

DR. MOUNT: In your opinion, does this say anything different than I have already said?

MR. STEIN: No. I think it says the same thing, but the question here was, do you still stand with this?

I said you had even defined it further.

DR. MOUNT: I think I do; yes.

MR. STEIN: The answer to that is, he stays with it and has simply reiterated it in his report. All right.

Now, may I make one further recommendation here, that in order to do this work we need very close cooperation with the States involved, and that in order to accomplish this work, the conferees here, with representation perhaps from our Atlanta office as well as the Dallas office, constitute a technical committee which will be kind of a directing group and an advisory group to get into specifics on the work that has to be done? Is this agreeable?

I think in view of the magnitude of the problem, there very well may be some considerable Federal funds available for this. We will be very grateful for any assistance in personnel, advice or anything we can get from the States; but, recognizing your position, I think in reality we will be prepared to underwrite the work financially.

MR. JONES: What about personnel, though? I have more money than personnel now.

MR. STEIN: We recognize that. The resources consist of people and equipment.

MR. JONES: You have them all tied up.

MR. TRYGG: Of course, you will allow the States to do everything they are doing?

MR. STEIN: Oh, yes. This is in the law. This is what I wanted to point out. Anything the States can do, we should not do and won't do. That would be a waste of Federal time and money, and as soon as we can turn this back to the States, we will do that.

MR. TRYGG: That has not always been the case. Jerry and I have been fighting about that. However, I will just take your statement. That's all.

MR. JONES: Will you clarify for the record what you mean by "you will turn it back to the States as soon as possible"?

Would you: please clarify the record on it.

MR. STEIN: Yes.

I would also suggest that if appropriate, the technical committee, composed of the conferees, should make a recommendation. If you think that it would serve any useful purpose to have another conference, you can make a recommendation, and a conference will be called upon the call of the Chairman.

I would hope that this would solve the situation and that we would be able to disengage without calling one, but we very well may feel the necessity for that. However, this should come from this technical committee, and we can leave ourselves open on that.

I do think too that we should have some kind of a terminal operation, and the technical committee should prepare a report or two, so that we can have a record of what is done.

At what intervals do you think you would want to prepare a report? Six months or a year?

MR. JONES: Don't ask me.

MR. LAFLEUR: I don't think that we can consider time on a progress report. We are just beginning this monitoring program, sampling program here, and a lot of the kinks in this thing, in long, drawn-out sampling and analytical procedure, have not been ironed out.

MR. STEIN: I would agree with you, but as I envision this, this may very well involve considerable sums of money.

Someone is going to have to prepare a report on how these Federal funds were expended.

MR. LAFLEUR: That's right.

MR. STEIN: I would suggest it would be better if this were a cooperative report than a report that we would just prepare.

It is my suggestion. Realizing the magnitude of the funds involved here, should Congress make them available, Congress is not going to let us wander around for a couple of years without getting something in writing as to what we have done. I recommend that we try to get this in the form of a joint State and Federal report.

MR. LAFLEUR: You are not the only one who has to give an account.

MR. STEIN: I would suggest, without holding to a time limit, that within a year after you receive this, you should at least get a progress report in, if not sooner, if it is appropriate.

MR. TRYGG: Murray, I think it certainly would help us if we had even a letter of summary or tabulation about the time of the low water flow this year, which is only four months off -- at least, some kind of a steer -- because if I get this low river flow with Endrin appearing in our water, I certainly would like to be in a position to say what we are doing about that.

MR. STEIN: Dr. Breidenbach handled that.

Dr. Breidenbach, did you hear that?

DR. BREIDENBACH: No, sir.

MR. STEIN: Will you come up and listen to this? What Mr. Trygg wants to get is a tabulation of when he can expect low river flows.

MR. TRYGG: No. I was asking you or suggesting that we ought to have a preliminary report on the direction we are going at least by the time we get to low water flows.

MR. STEIN: I am sorry.

MR. TRYGG: We have already got him working for us.

MR. JOHNSTON: When does that happen?

MR. TRYGG: In August of this year.

MR. STEIN: I would agree with that.

Is Mr. Krause in the room?

MR. COULTER: No, sir. He is gone.

MR. STEIN: All right. We have his deputy here.

As I see this job, Mr. Coulter, it seems to me that we are going to have to find one of these boys whom we can put the finger on in the Public Health Service and make him responsible for this job. Is that correct?

MR. COULTER: That is correct.

MR. STEIN: All right. That man will be designated by us very shortly, if Mr. Coulter and Mr. Krause don't have a man available already. They haven't discussed it with us, but that man will be available and he will be charged with getting you this report and having a consultation with you, I hope, before low flows set in this year.

MR. JONES: How often are you getting samples of your New Orleans water supply for Endrin now?

MR. TRYGG: Every week now. We have a carbon filter in the finished water too.

MR. JONES: Your water supply is upstream where?

MR. TRYGG: We have 34 of them at the same location.

MR. JONES: Ed, do you have one at Vicksburg there on samples?

MR. JOHNSTON: Yes.

MR. TRYGG: This is our last one, so we go all the way up.

MR. JONES: We might as well set it up now.

How much help can you get to get a sample up further?

MR. STEIN: They are going to straighten it out.

MR. JONES: That is, so we can get the data.

MR. STEIN: We will make the adjustments on the sampling stations.

I think this is probably a question for technical discussion. I am sure this will be adjusted. I think you realize that the sampling point that we have at West Memphis was not designed for this problem or this study, and it is just gratuitous that it was there. Adjustments will have to be made, obviously, in sampling points for this work.

Are there any more comments from the conferees? Are there any more comments or suggestions that should go in the record?

Mr. Wood?

MR. WOOD: No.

MR. STEIN: Are we set?

MR. WOOD: I think so.

MR. STEIN: Mr. Jones?

MR. JONES: I move we adjourn.

MR. STEIN: How about you?

MR. SVORE: That is all.

MR. STEIN: Are you people set?

MR. LAFLEUR: Yes.

MR. TRYGG: Yes.

MR. JOHNSTON: Yes.

MR. STEIN: All right. I want to thank you all for coming, particularly the survivors. I think we had a very productive conference.

We stand adjourned.

(Whereupon, at 5:10 p.m., the conference was adjourned sine die.)